



US010850785B2

(12) **United States Patent**
O'Reilly

(10) **Patent No.:** **US 10,850,785 B2**

(45) **Date of Patent:** **Dec. 1, 2020**

(54) **BALANCE BIKE CONVERSION SYSTEMS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/359,788**

(22) Filed: **Mar. 20, 2019**

(65) **Prior Publication Data**

US 2019/0210677 A1 Jul. 11, 2019

Related U.S. Application Data

(63) Continuation-in-part of application No. 15/590,793, filed on May 9, 2017, now Pat. No. 10,300,974.

(60) Provisional application No. 62/454,342, filed on Feb. 3, 2017.

(51) **Int. Cl.**

B62K 19/34 (2006.01)
B62H 7/00 (2006.01)
B62J 25/00 (2020.01)
B62M 1/36 (2013.01)
B62K 13/00 (2006.01)
B62M 3/08 (2006.01)
B62M 3/16 (2006.01)

(52) **U.S. Cl.**

CPC **B62H 7/00** (2013.01); **B62J 25/00** (2013.01); **B62K 13/00** (2013.01); **B62K 19/34** (2013.01); **B62M 1/36** (2013.01); **B62M 3/08** (2013.01); **B62M 3/16** (2013.01)

(58) **Field of Classification Search**

CPC B62H 7/00; B62K 13/00; B62K 19/34
See application file for complete search history.

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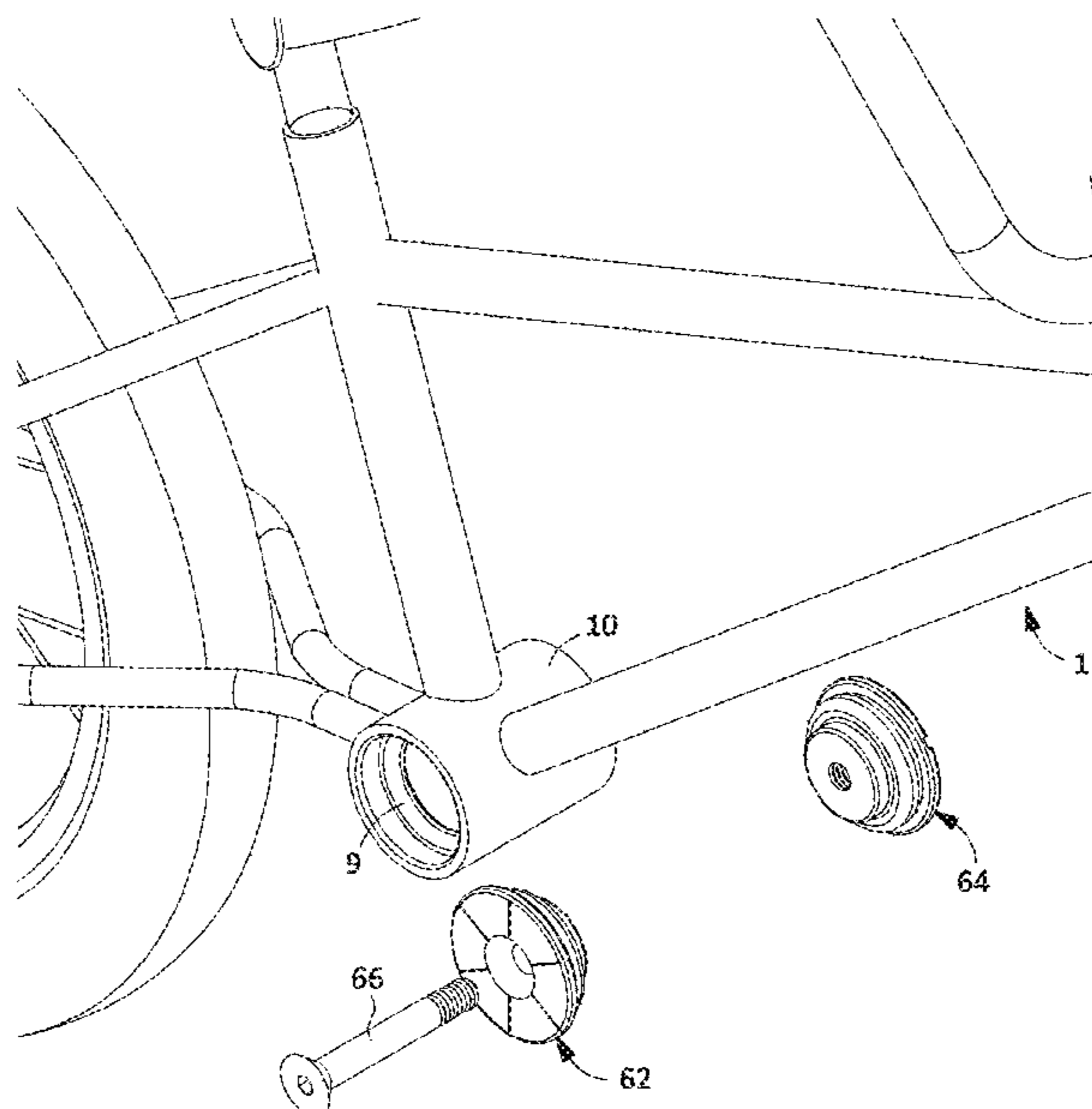
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Primary Examiner — Tony H Winner

(57) **ABSTRACT**

A balance bike conversion system may include first and second protective inserts, each having an interface adapted to engage opposite ends of a bicycle bottom bracket. A connector may be adapted to connect the first and second protective inserts, and may be adapted to adjust the distance between the inserts, thereby accommodating variability in the width of the bottom bracket. The system may further include adapters to enable the system to be used with bicycles having bottom brackets with different diameters, and may use an elastomeric gasket to accommodate larger bottom brackets. The protective inserts and/or adapters may provide mechanical support to the bottom bracket, thereby protecting it from damage.

14 Claims, 29 Drawing Sheets



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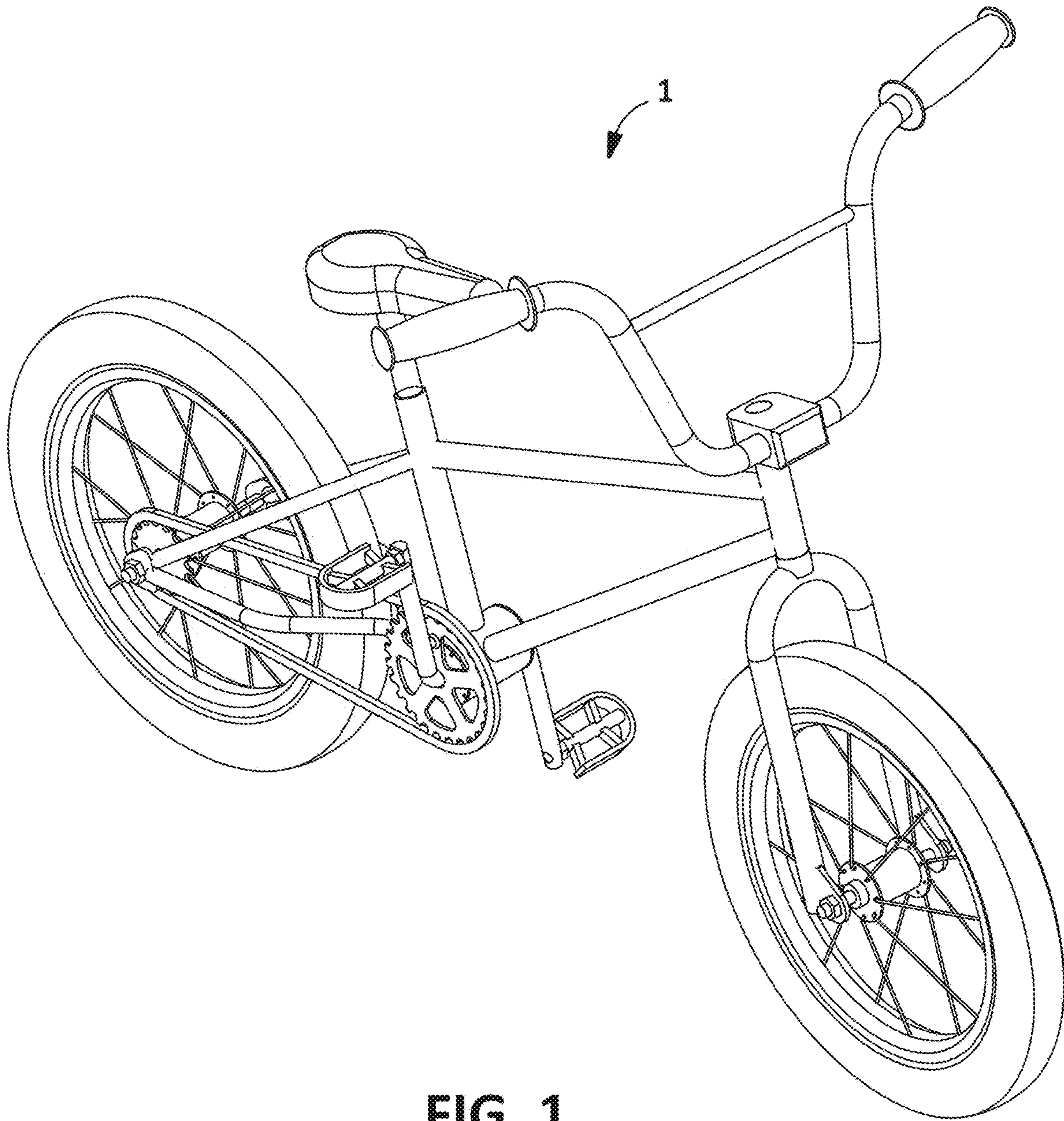
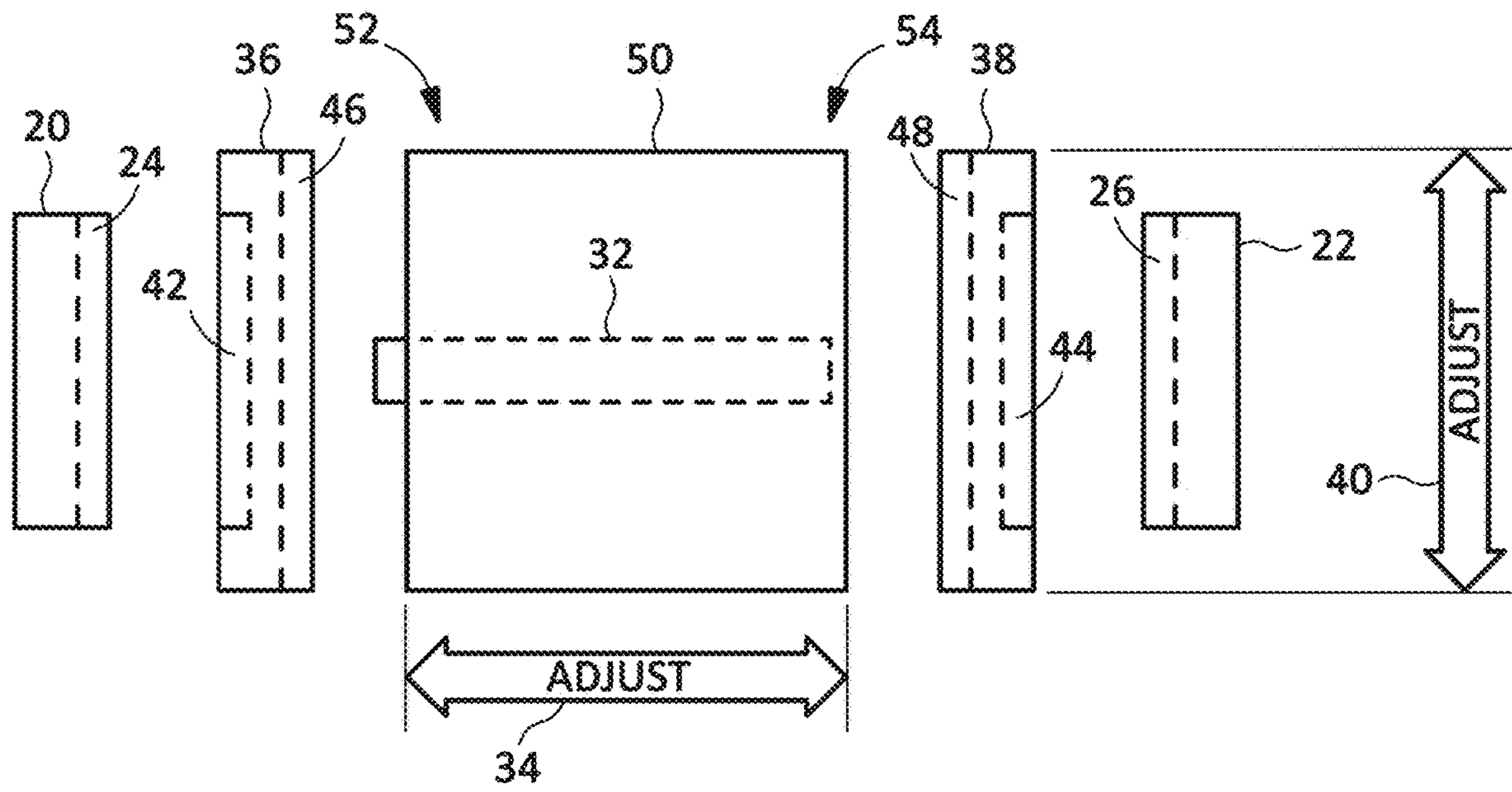
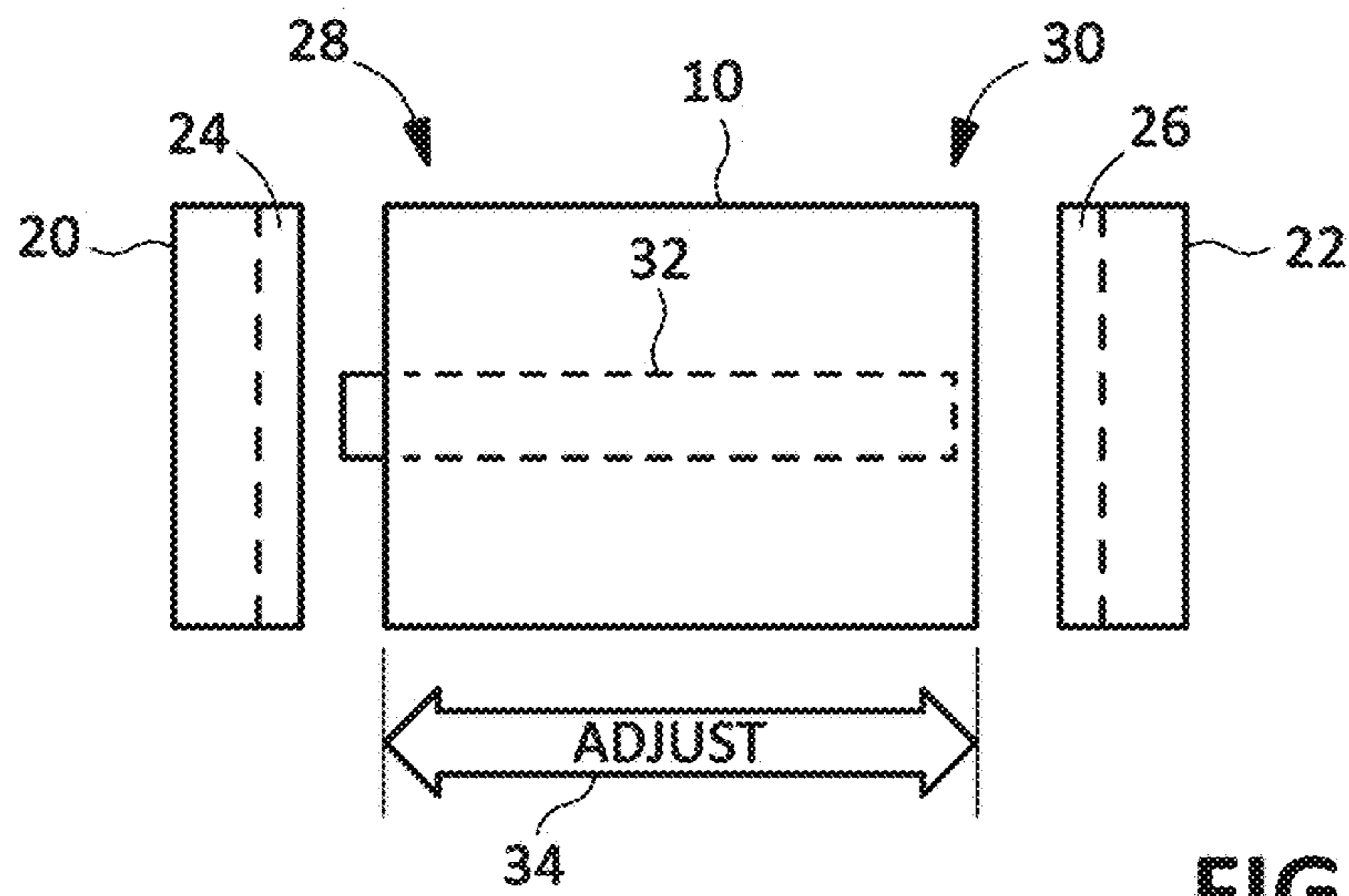


FIG. 1
(Prior Art)



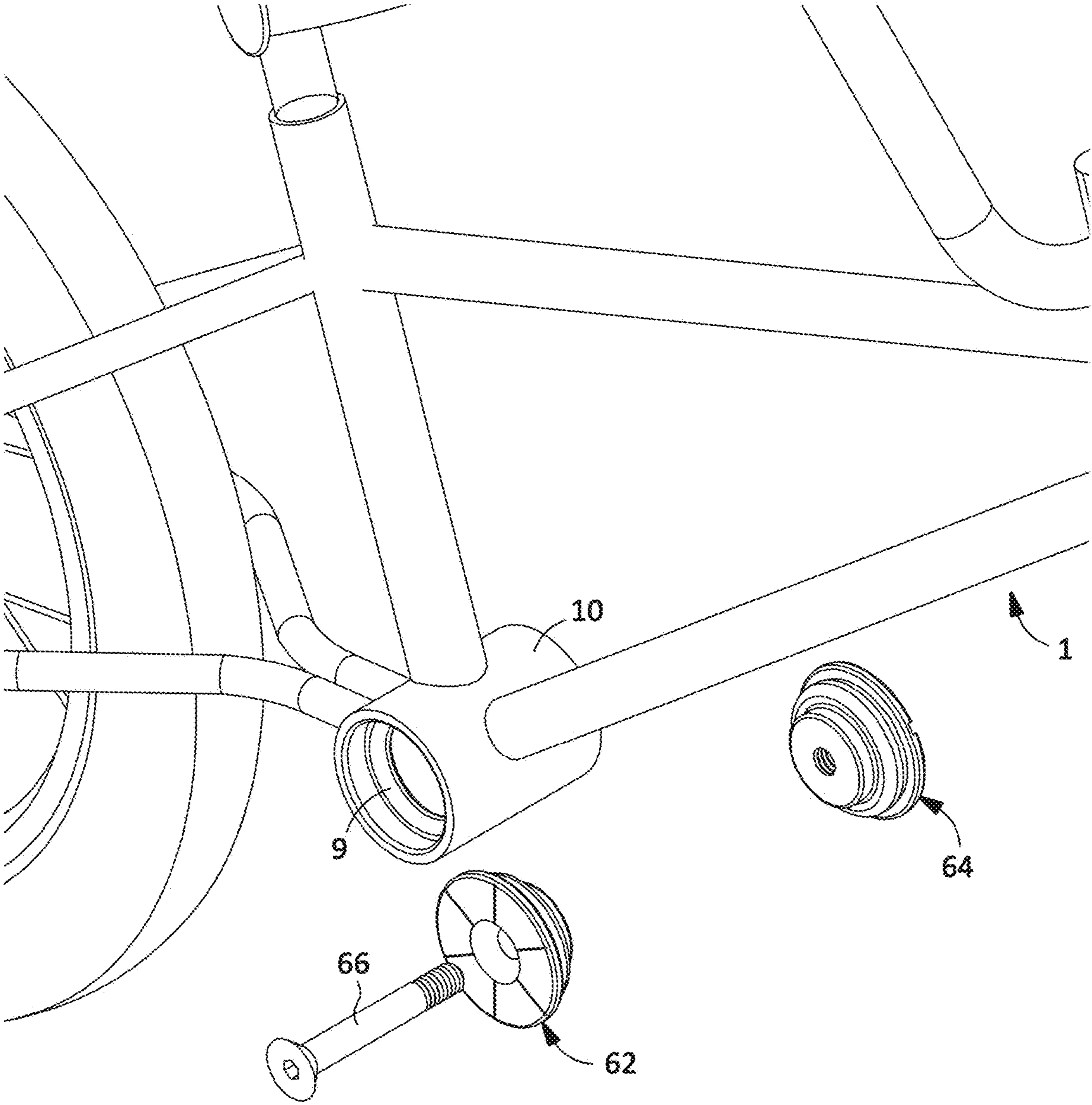


FIG. 5

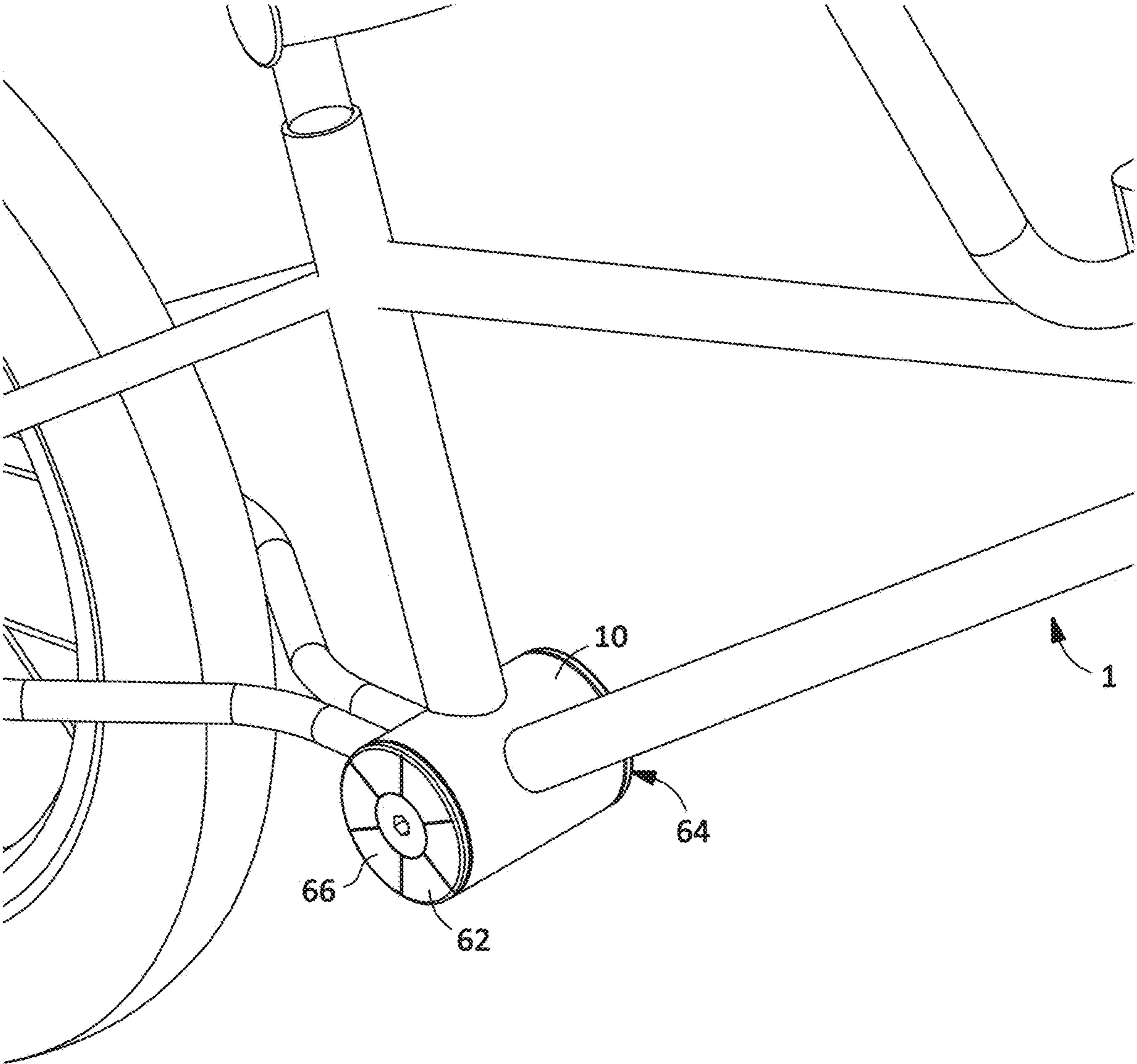


FIG. 6

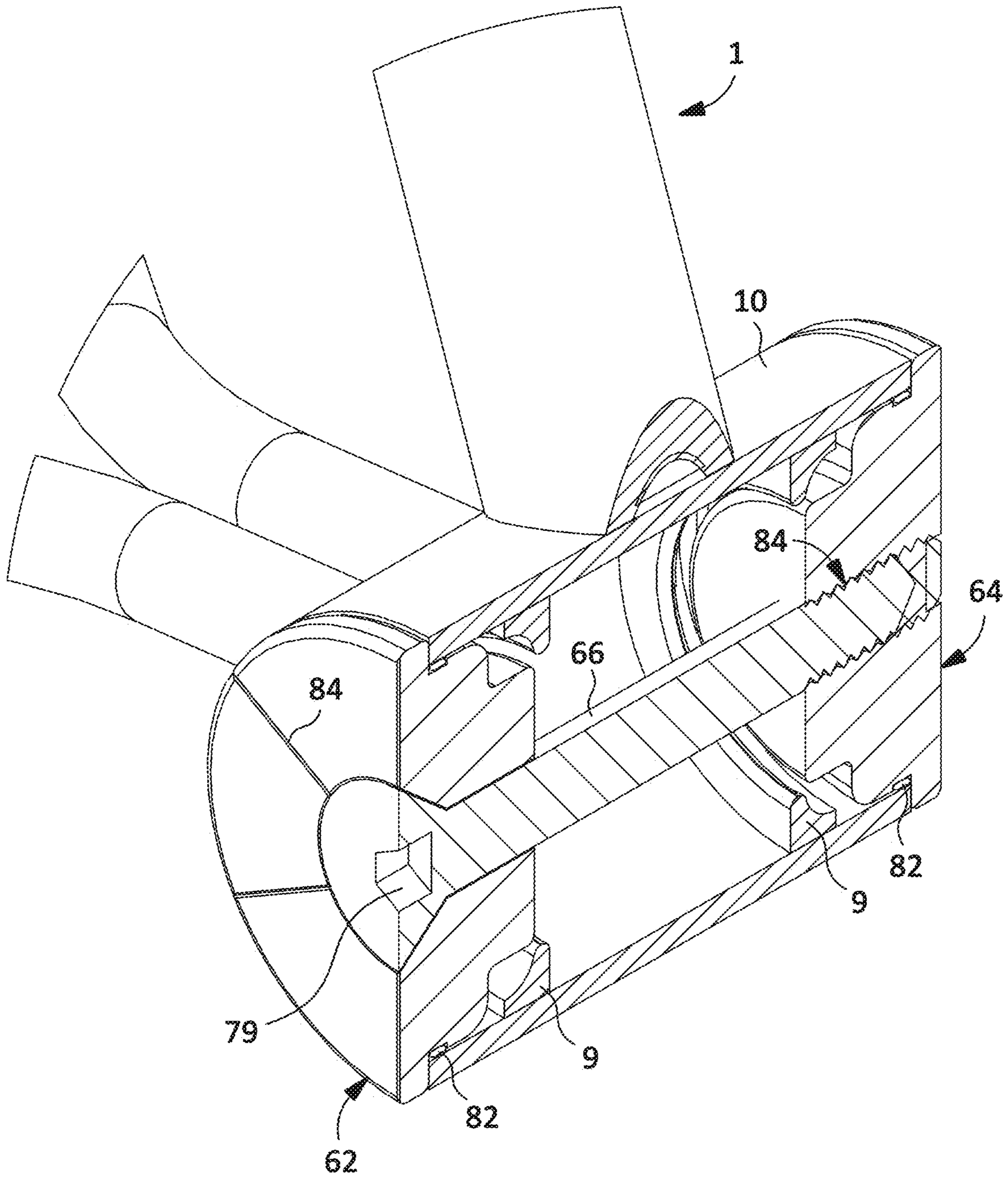


FIG. 7

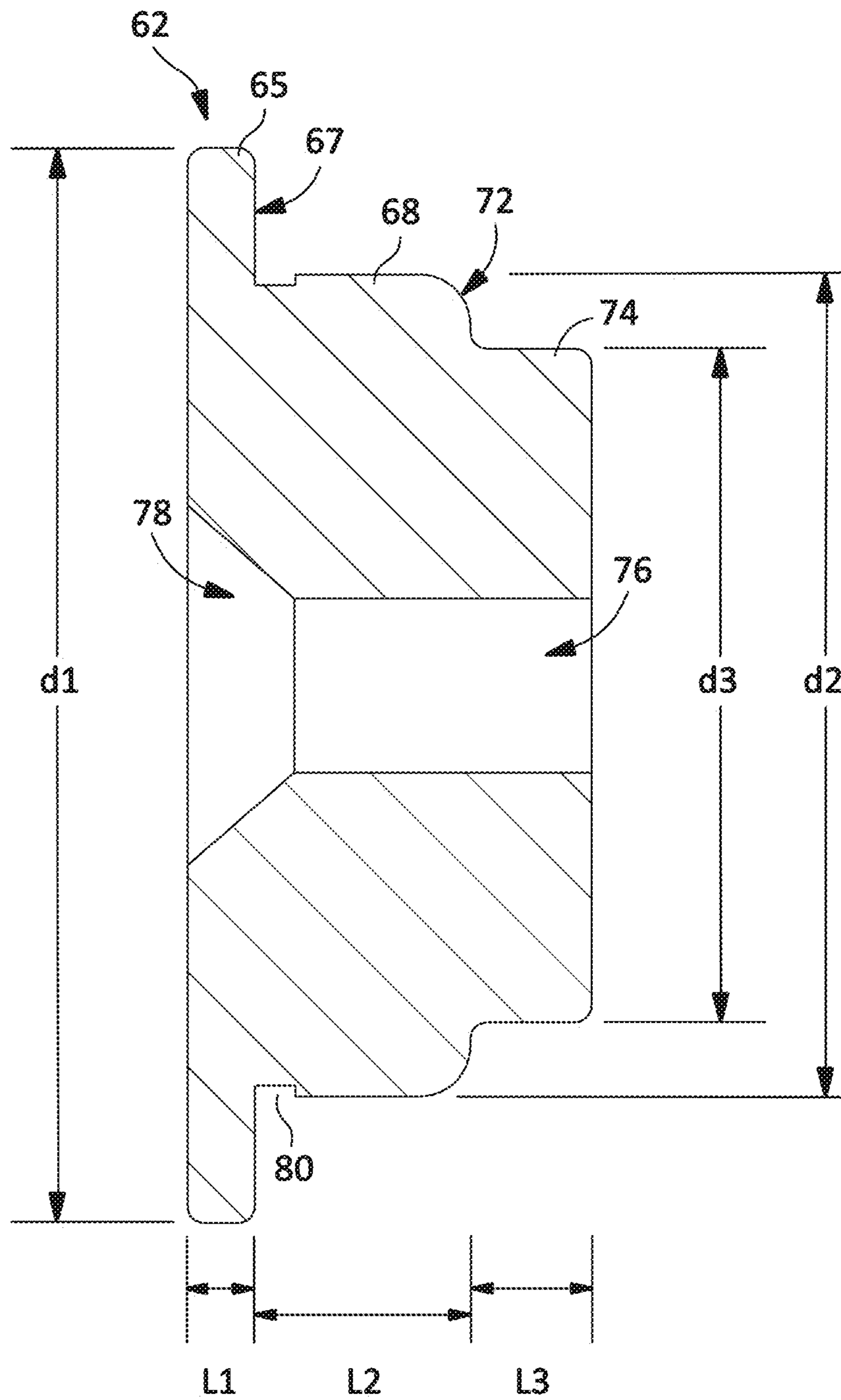


FIG. 8

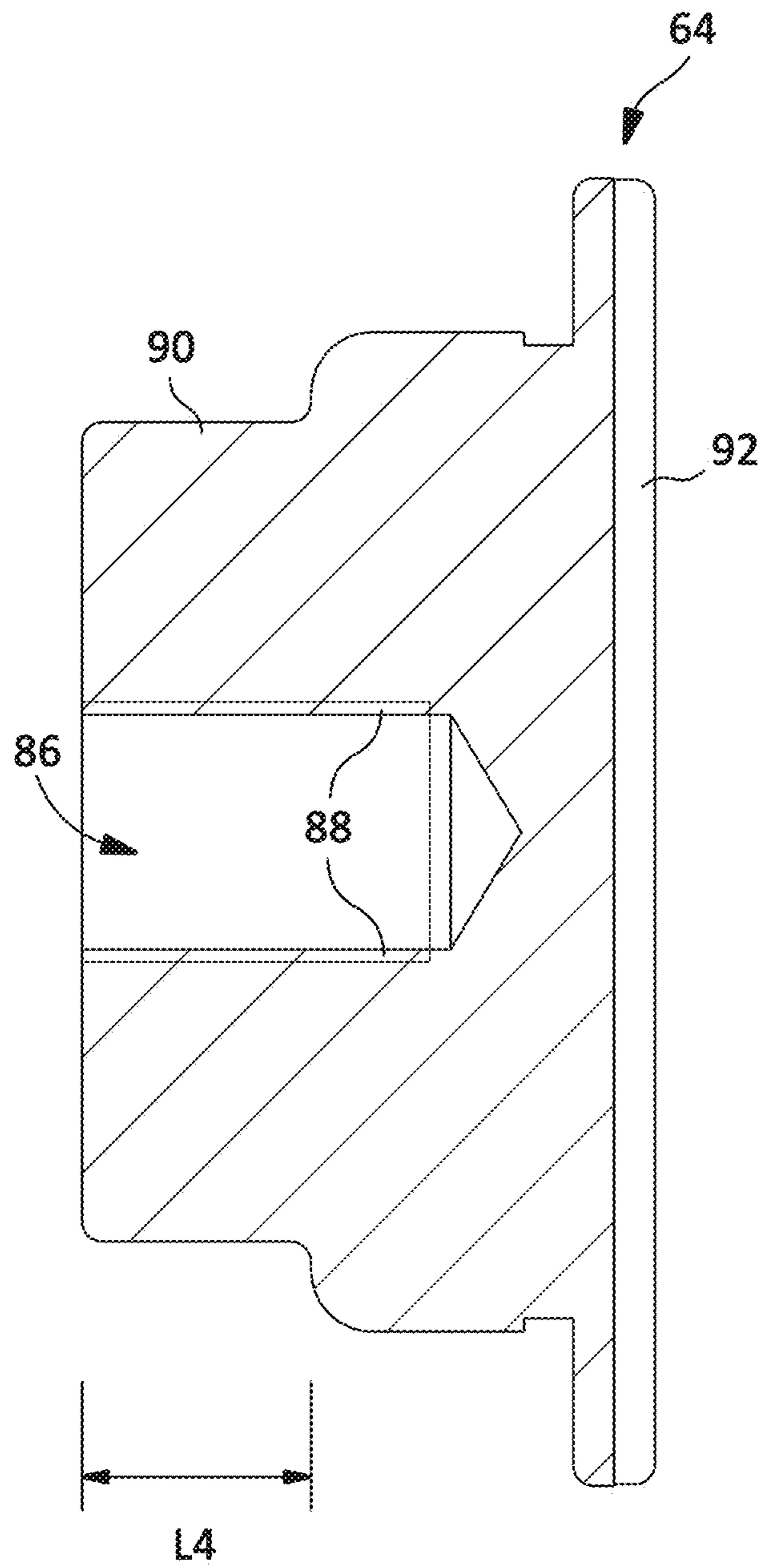


FIG. 9

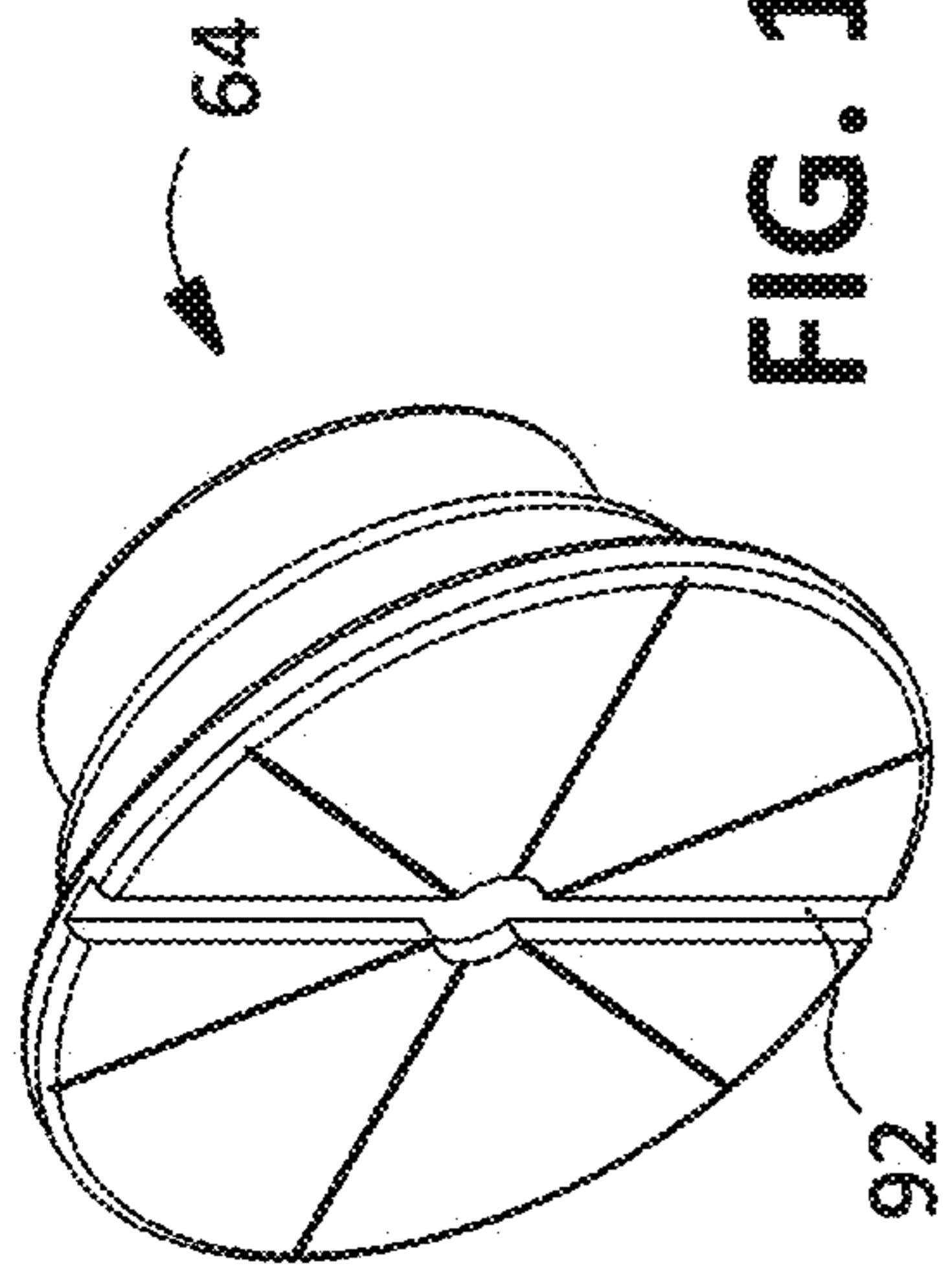


FIG. 10

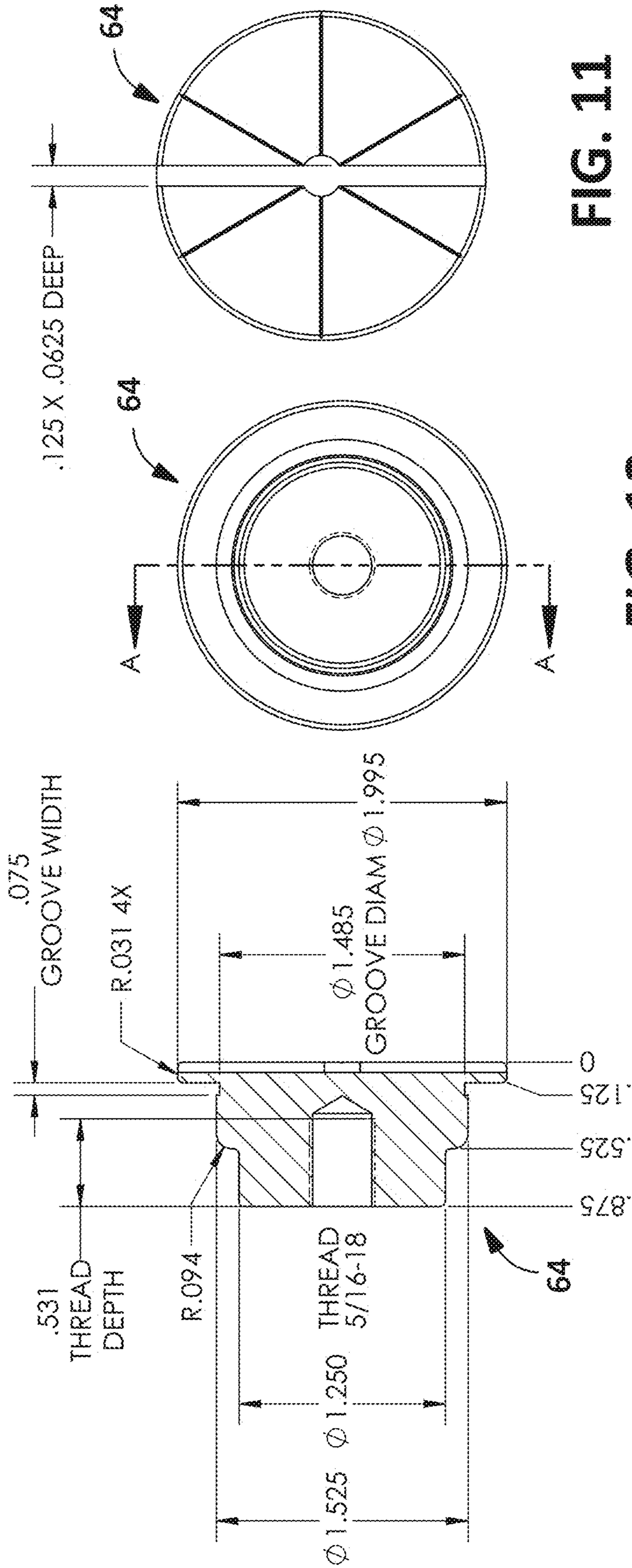


FIG. 11

FIG. 12

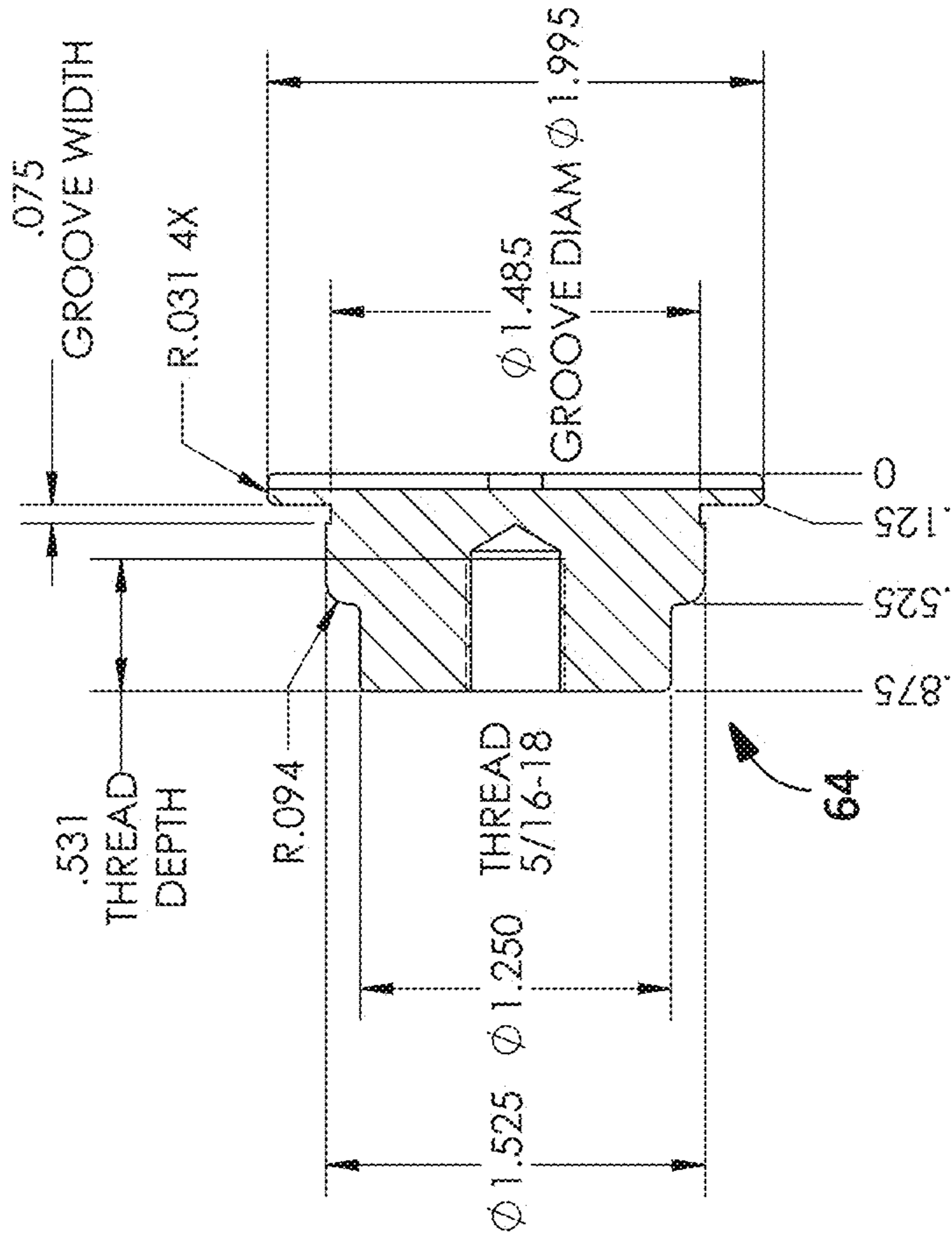


FIG. 13

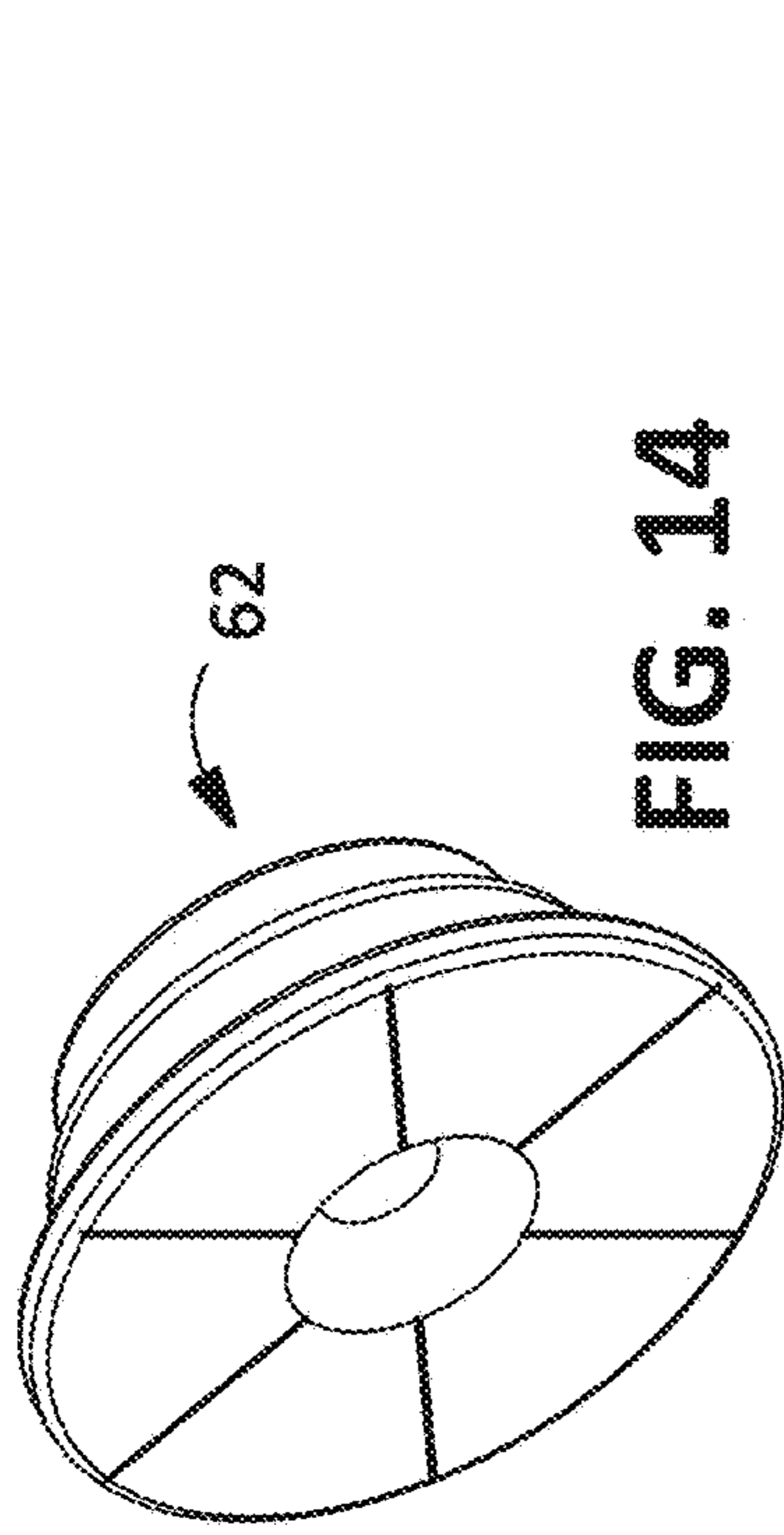


FIG. 14

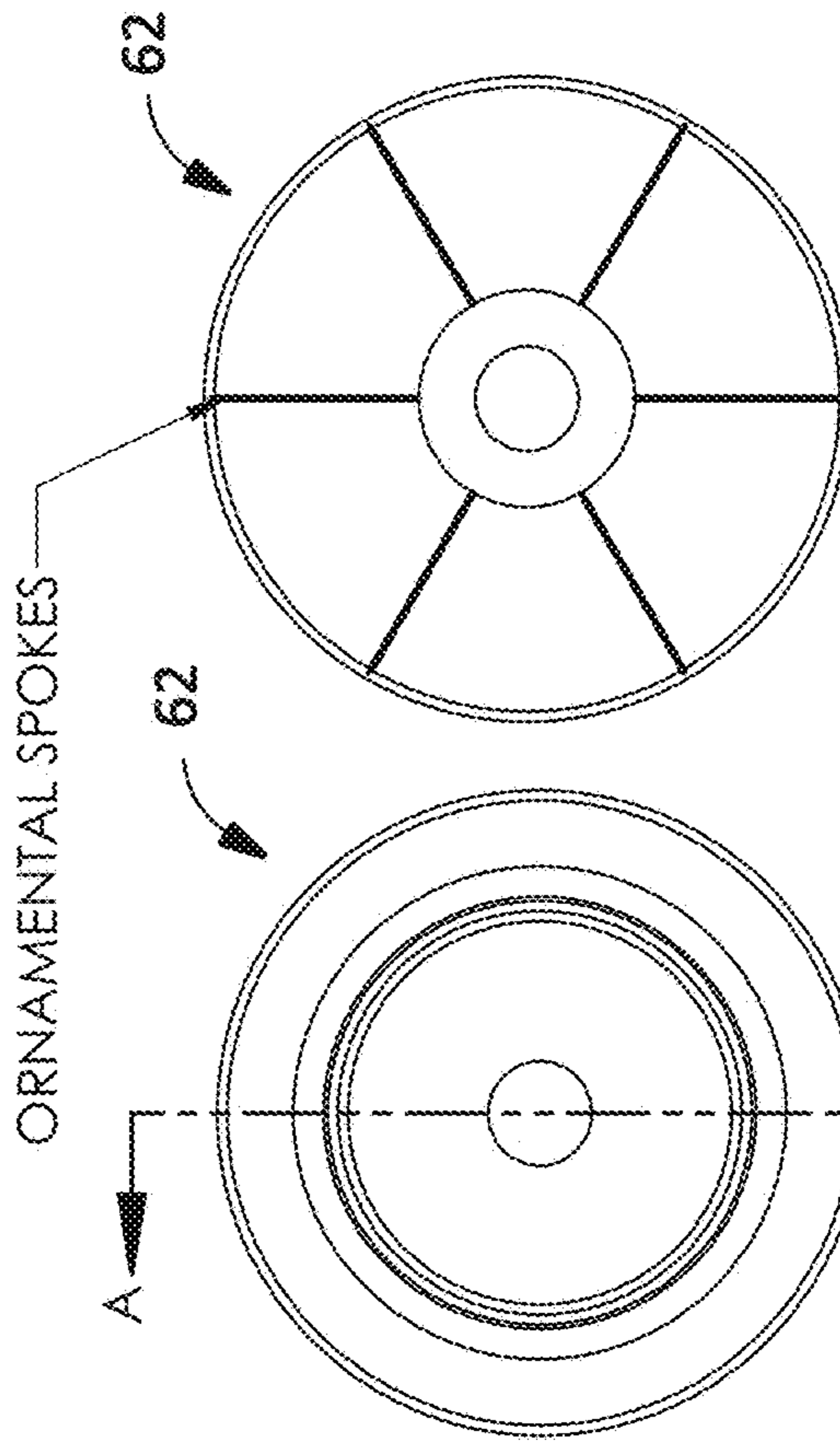


FIG. 15

FIG. 16

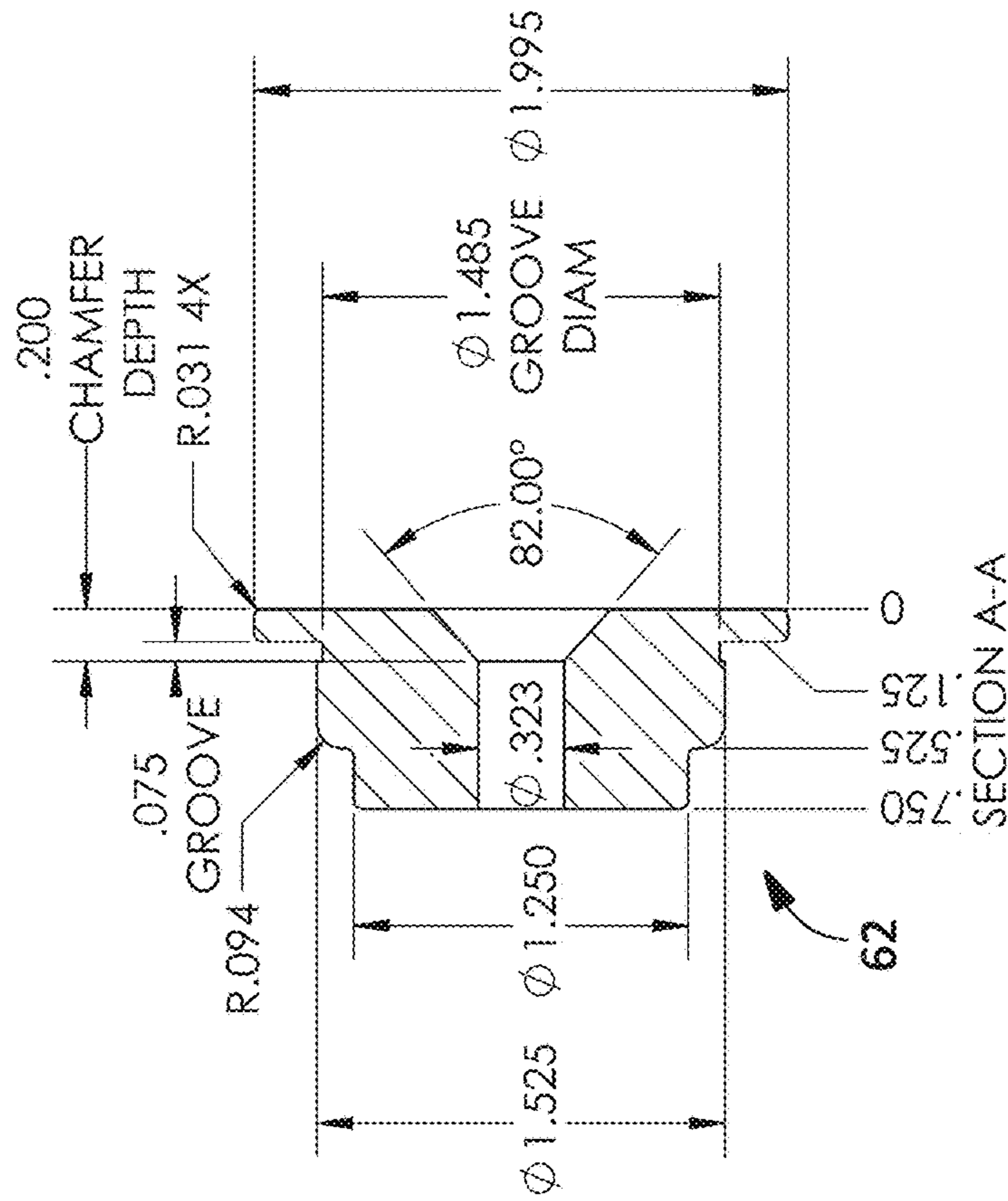


FIG. 17

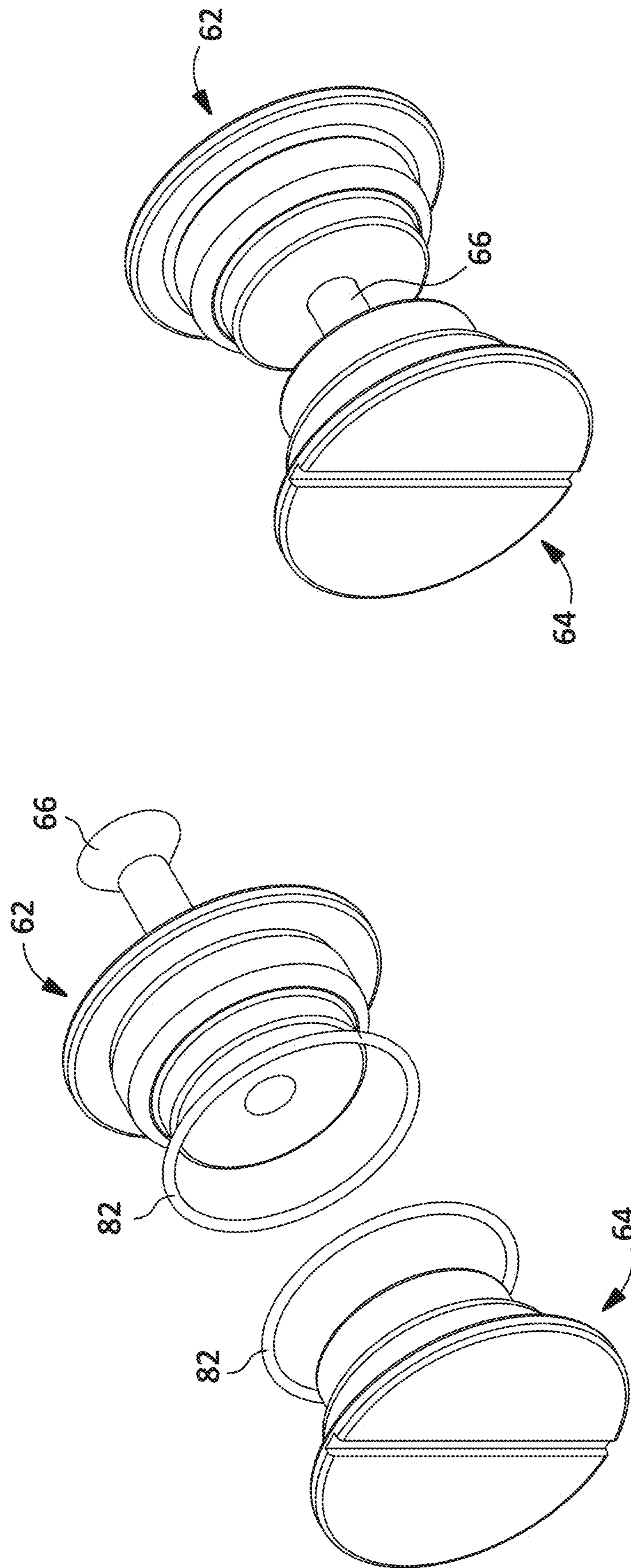


FIG. 19

FIG. 18

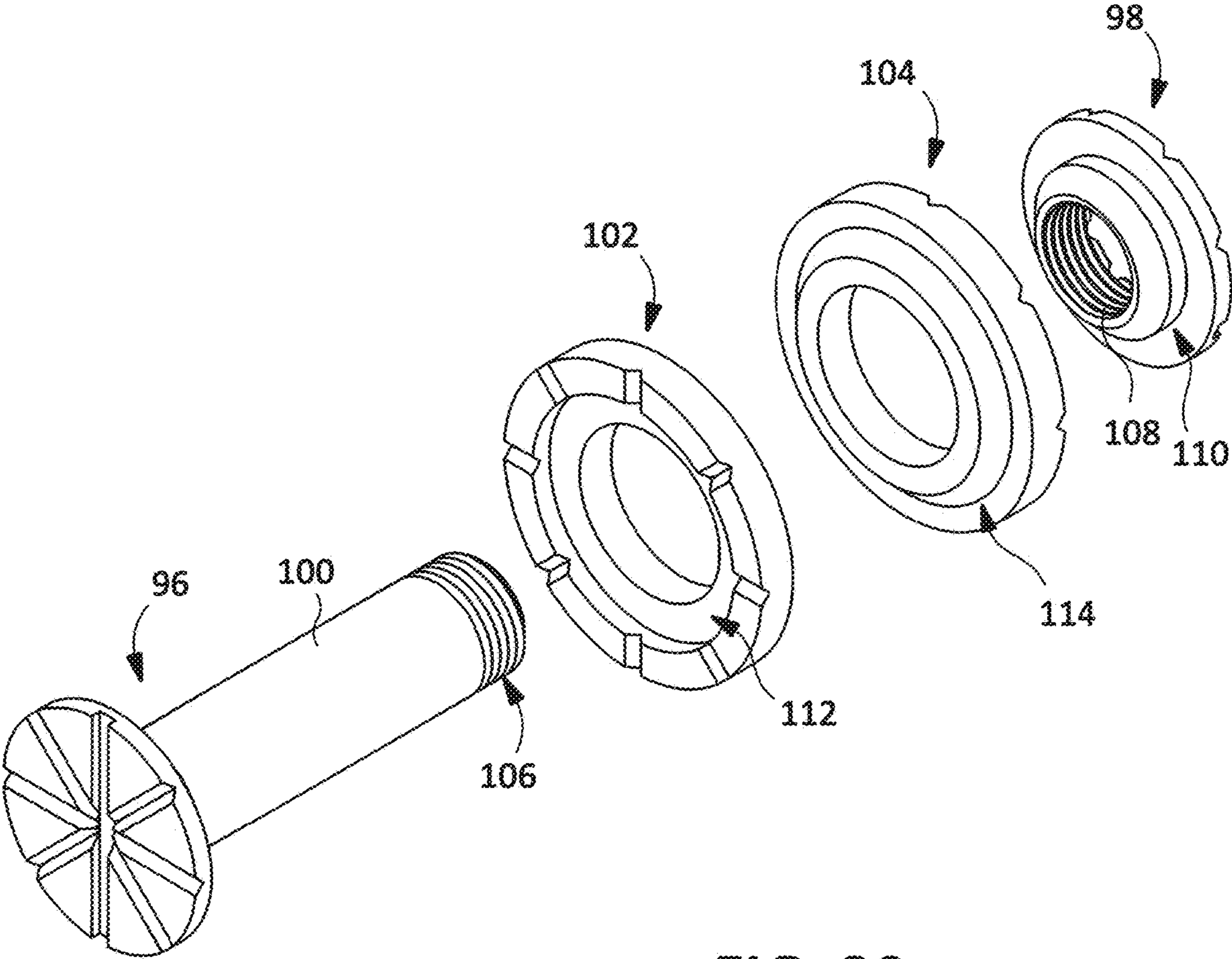


FIG. 20

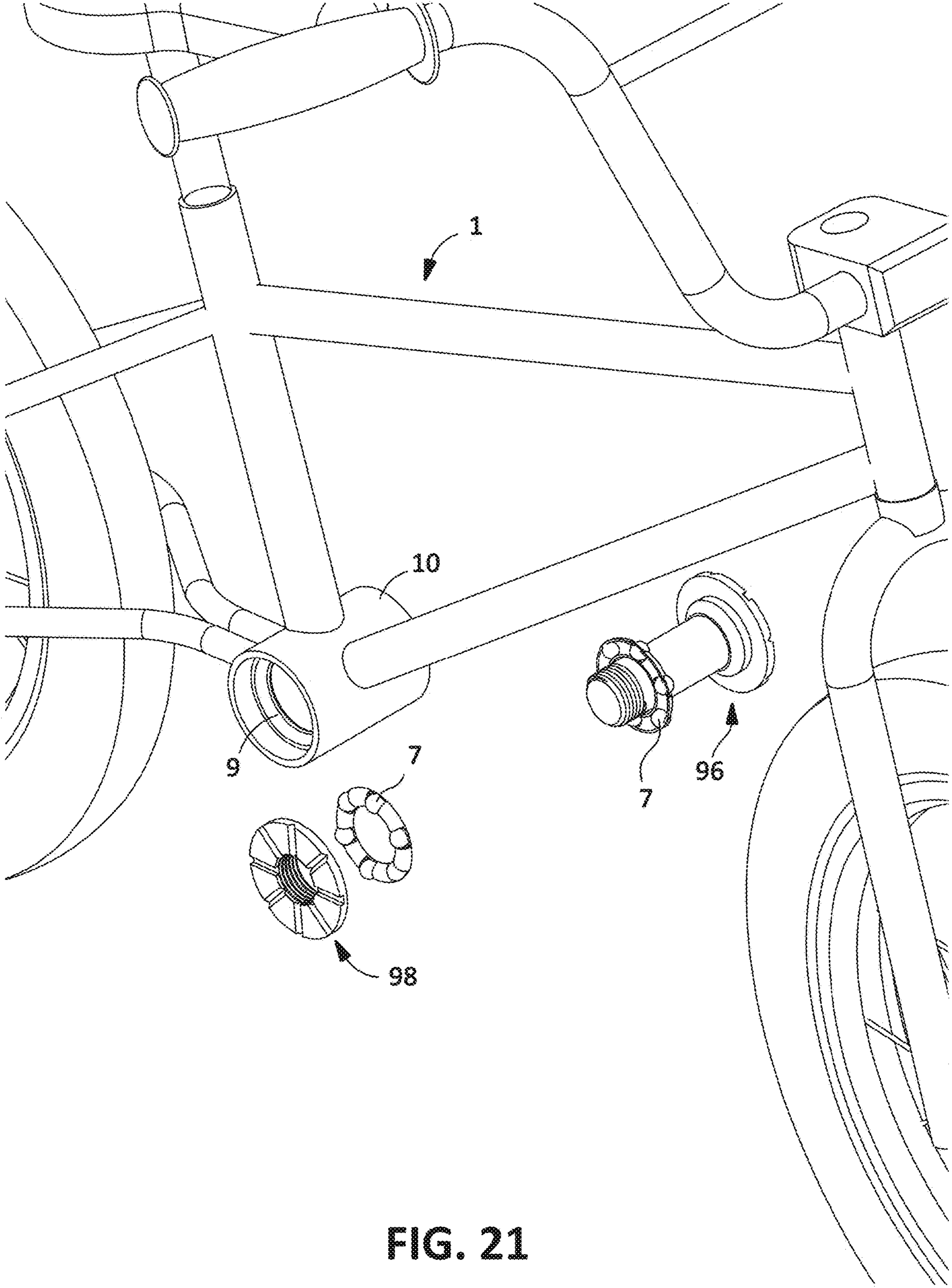


FIG. 21

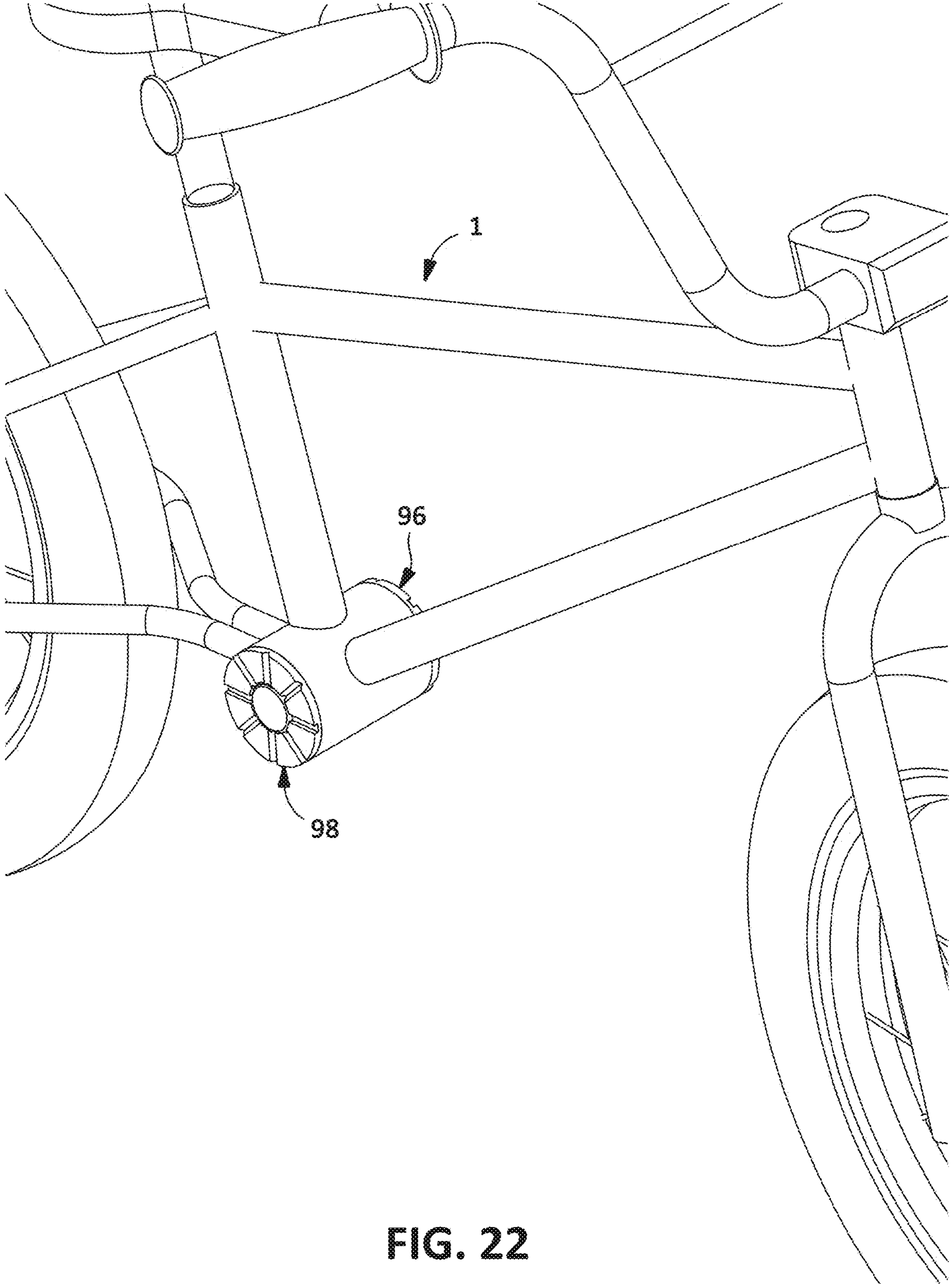


FIG. 22

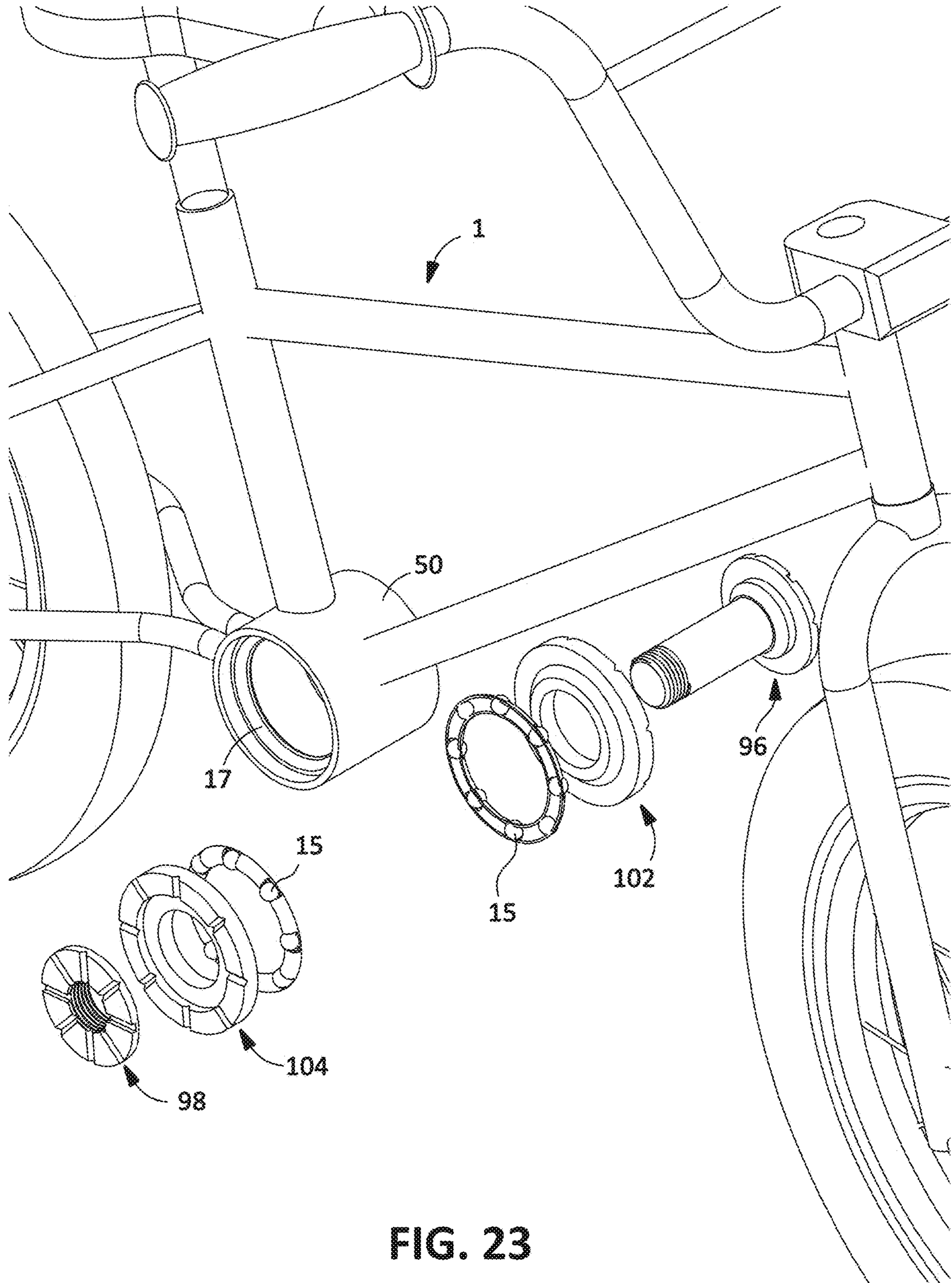


FIG. 23

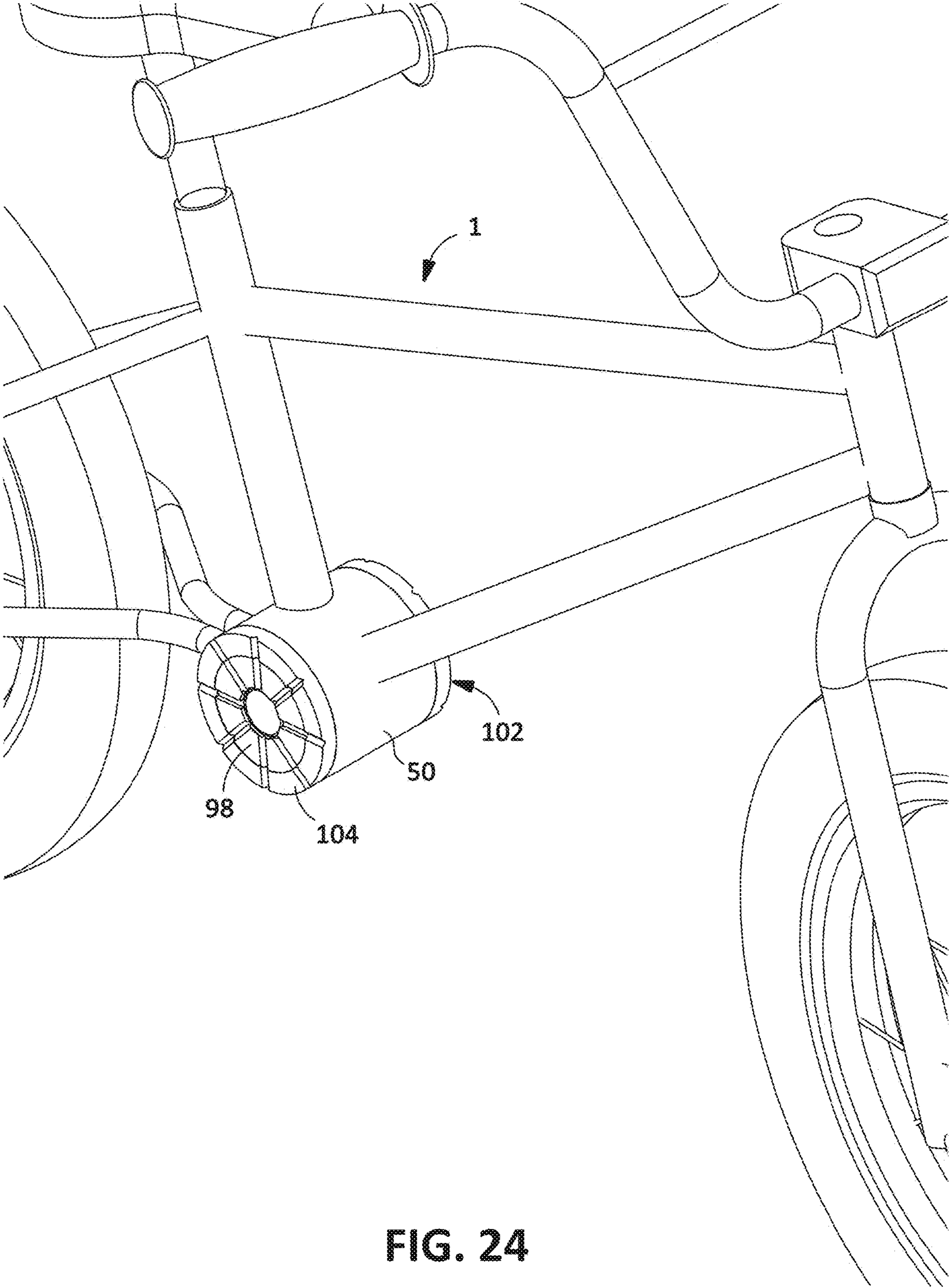


FIG. 24

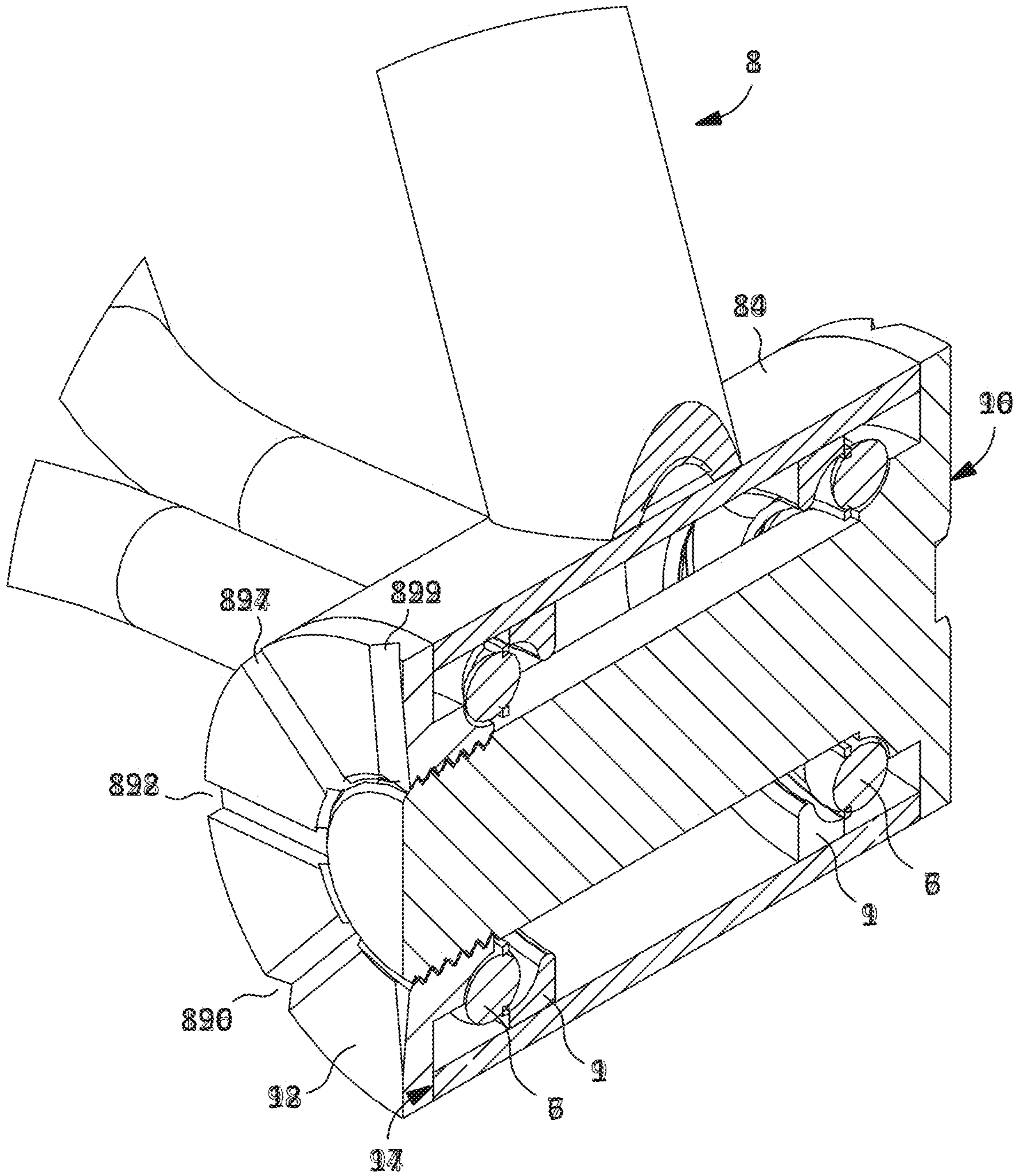


FIG. 25

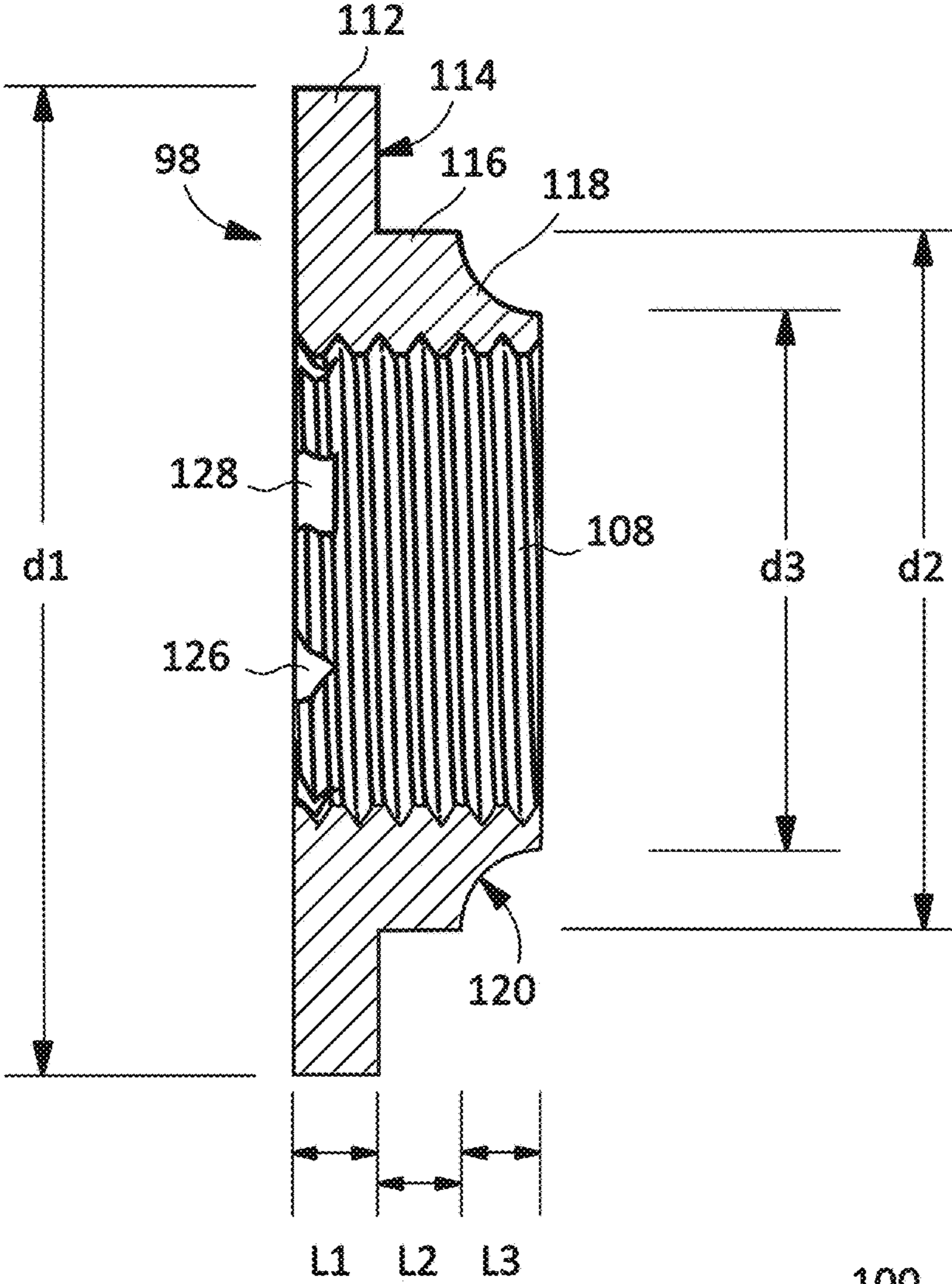


FIG. 26

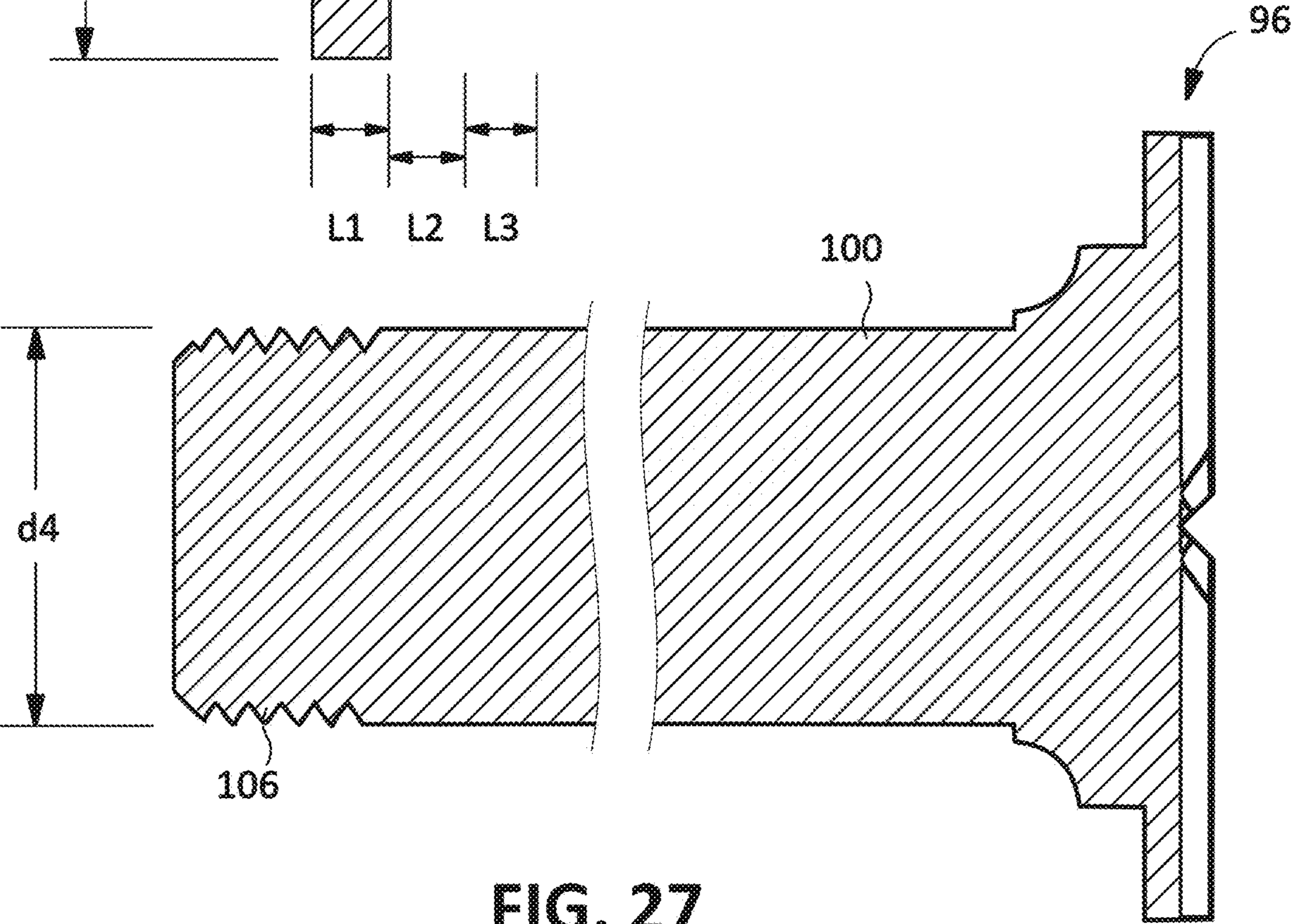


FIG. 27

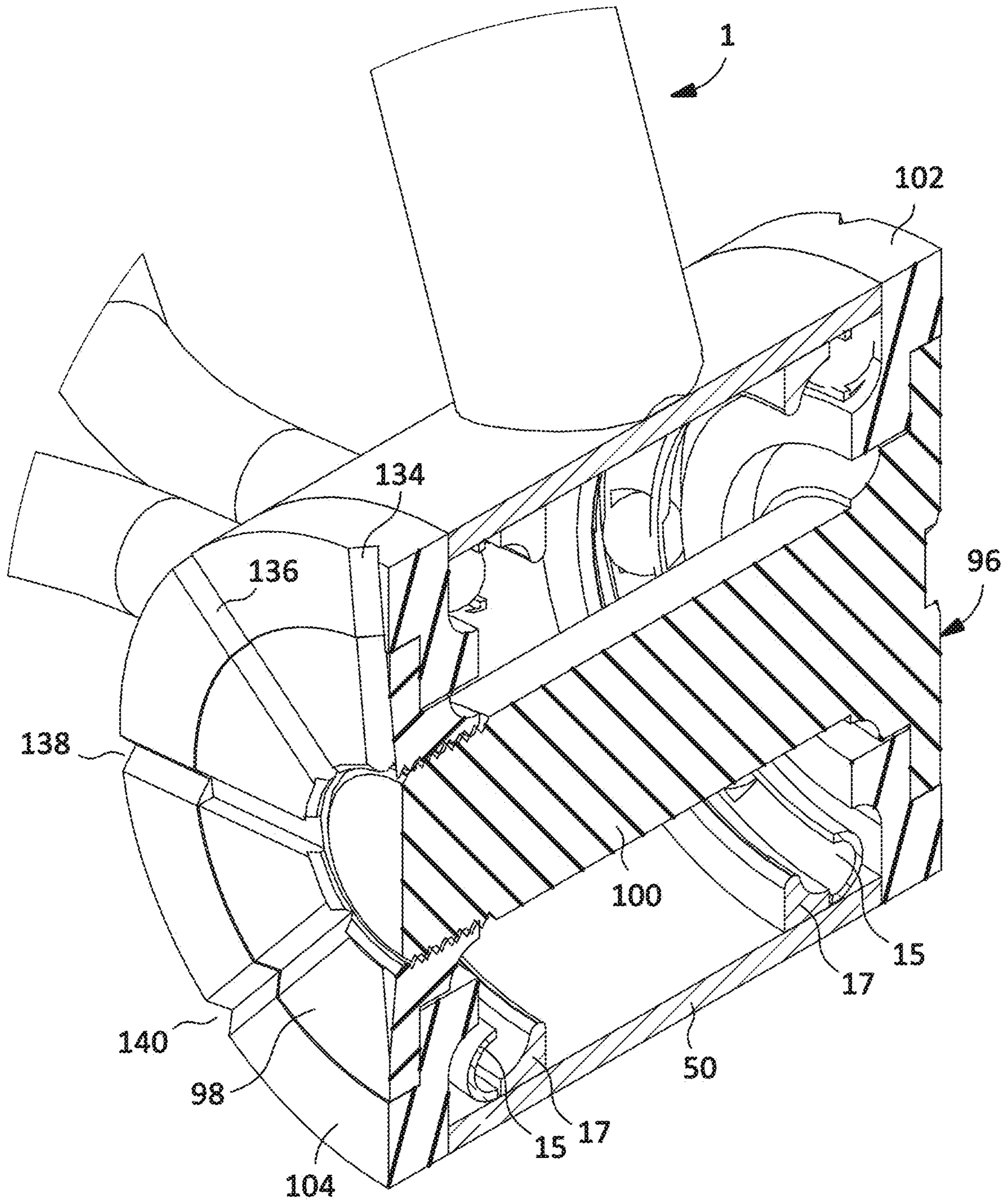


FIG. 28

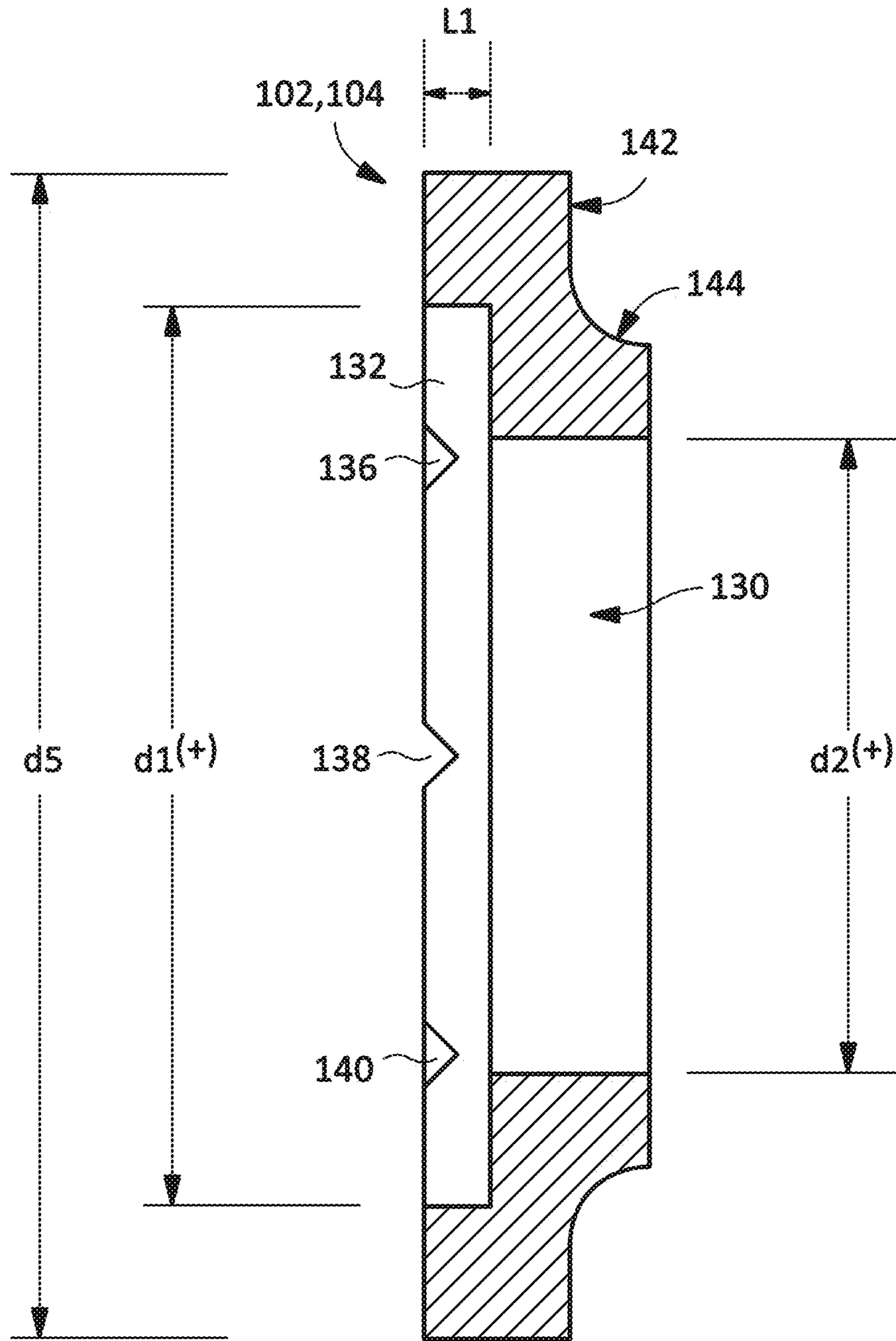


FIG. 29

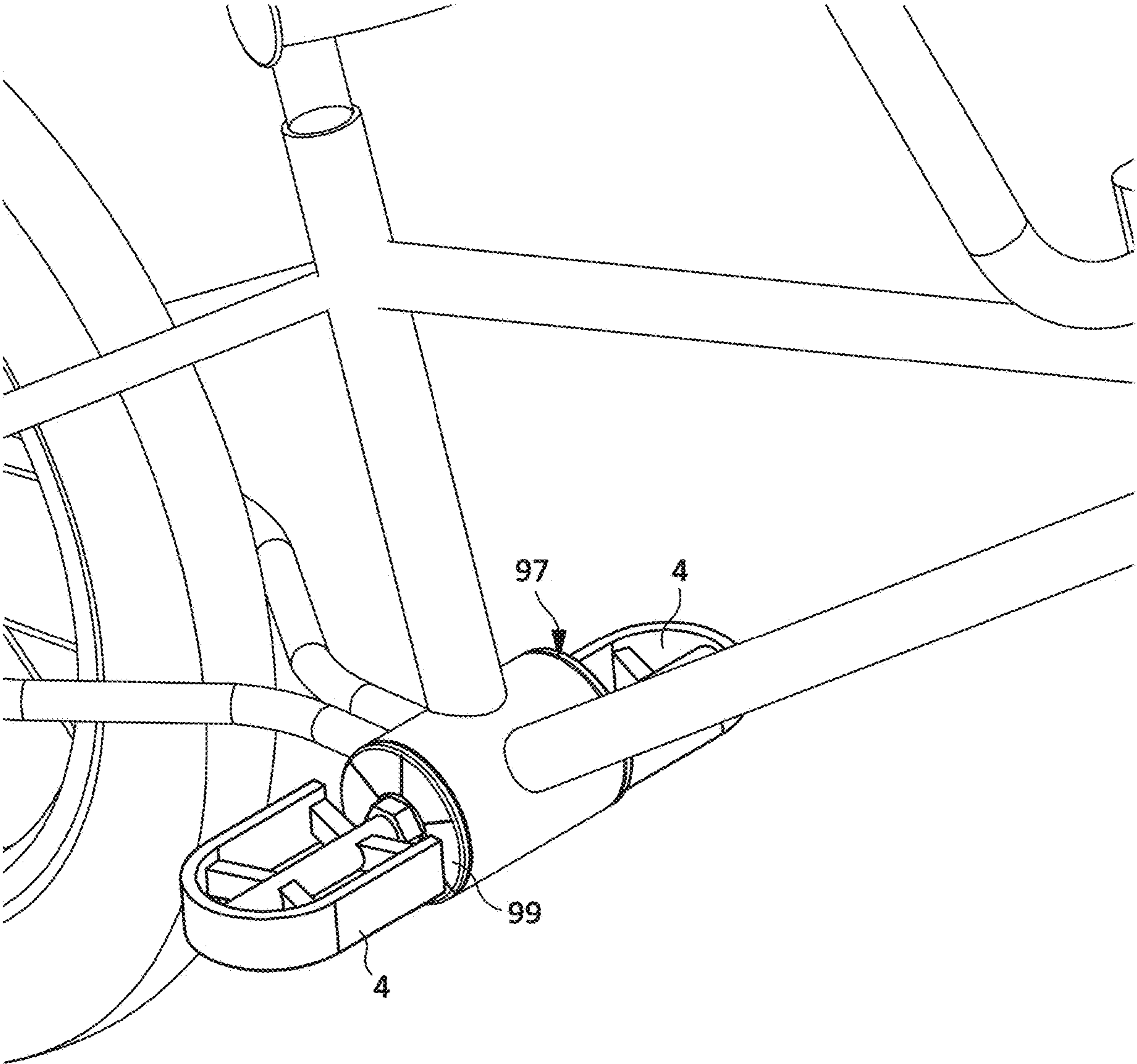


FIG. 30

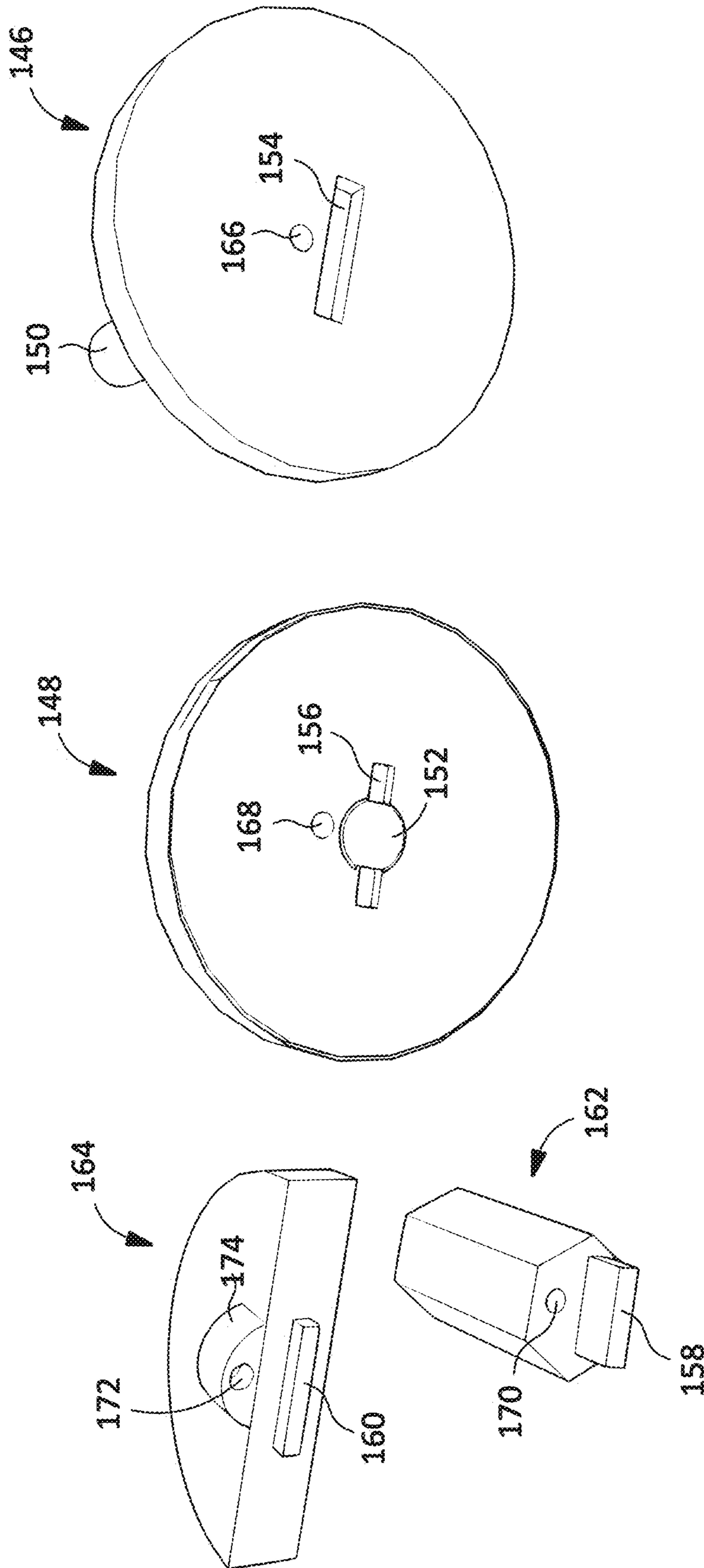


FIG. 31

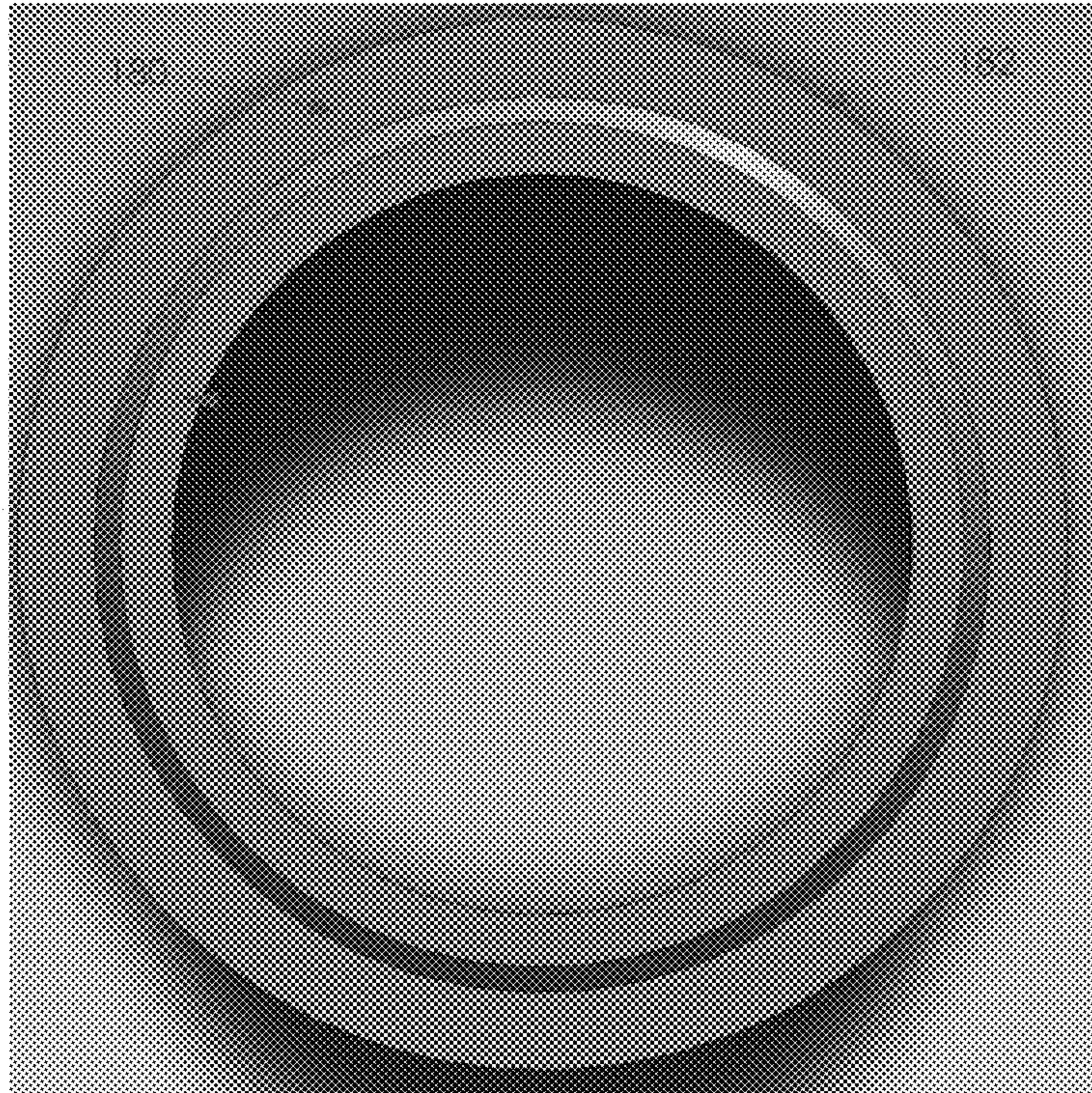


FIG. 32

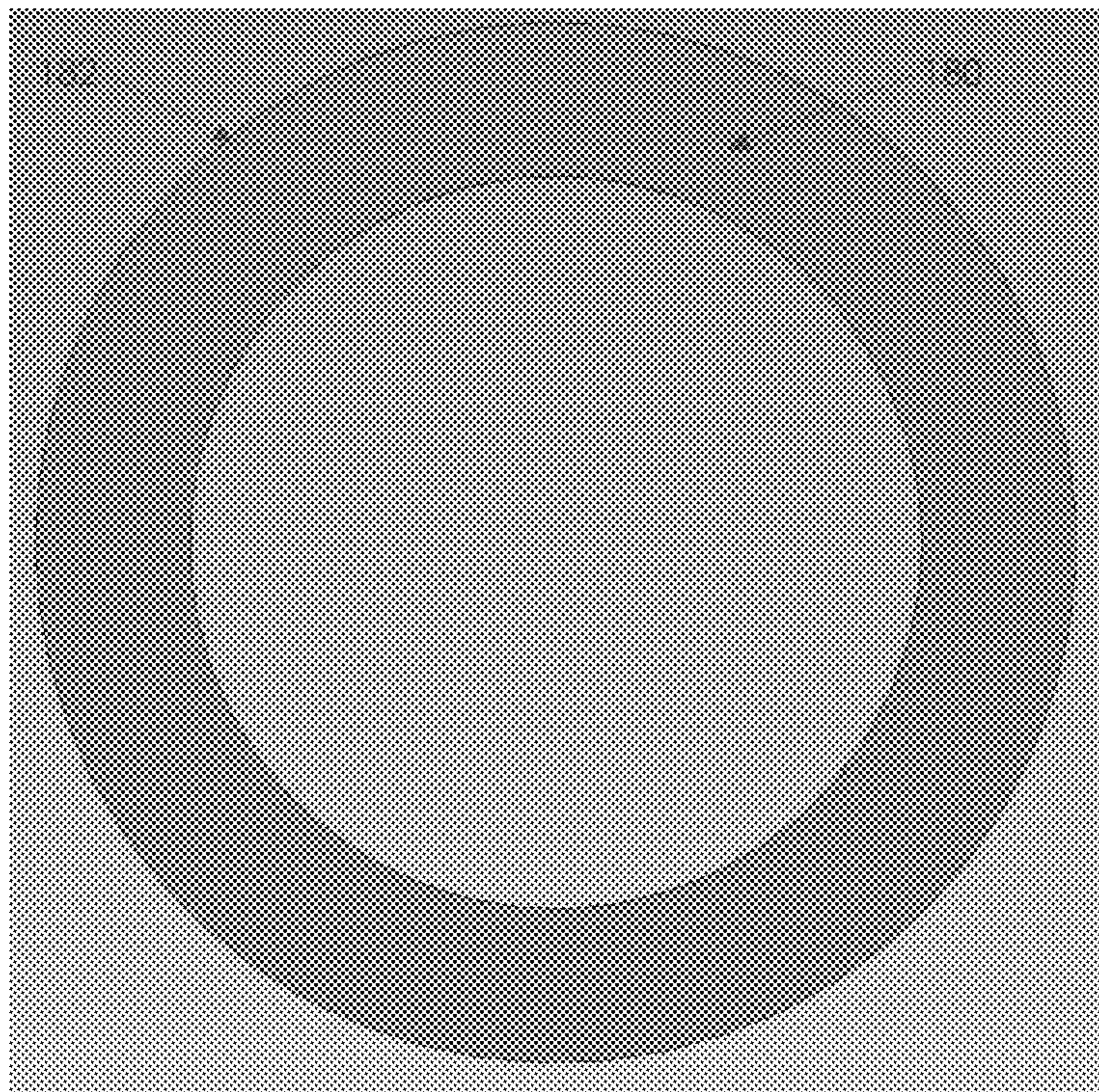


FIG. 33

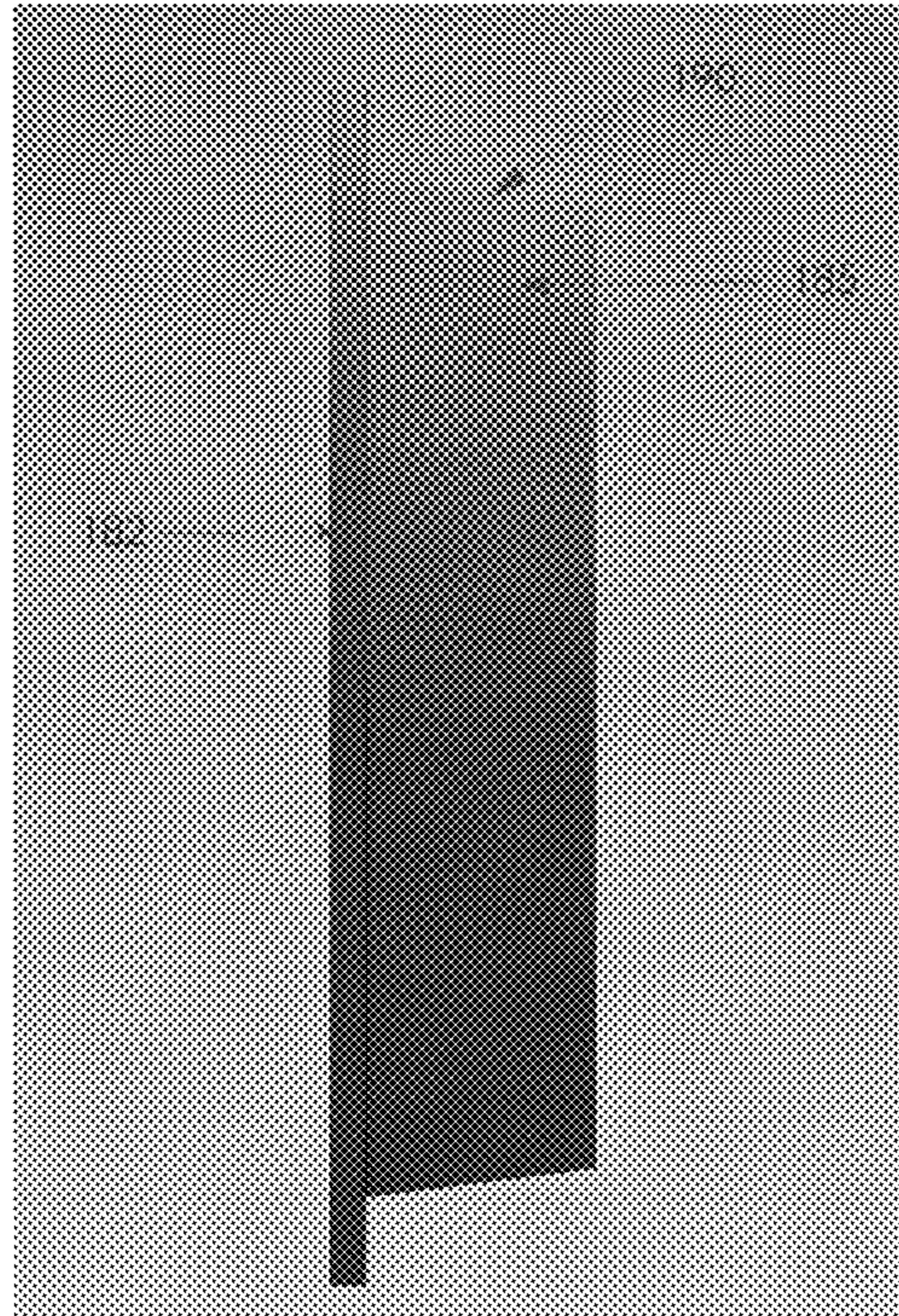


FIG. 34

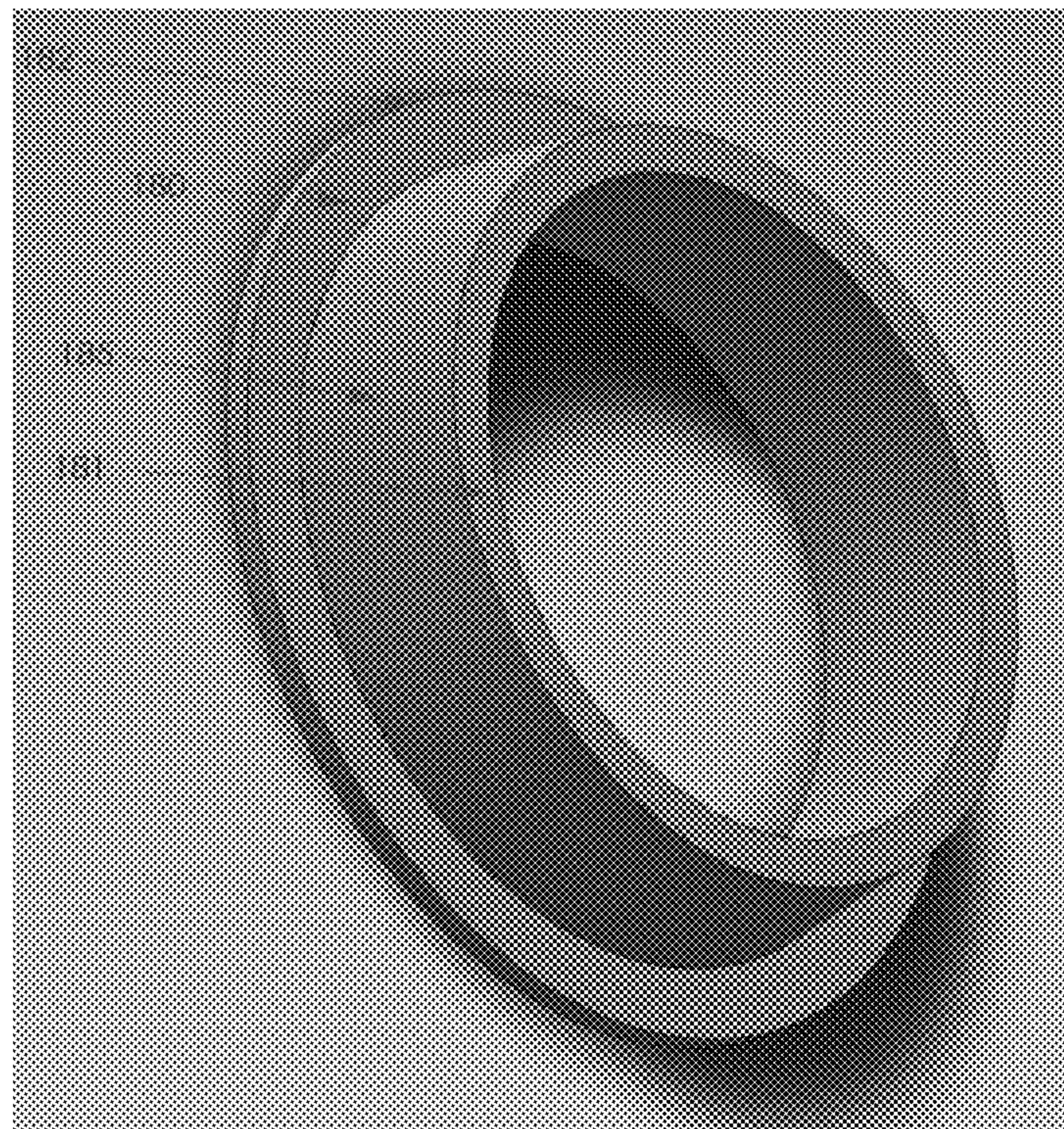


FIG. 35

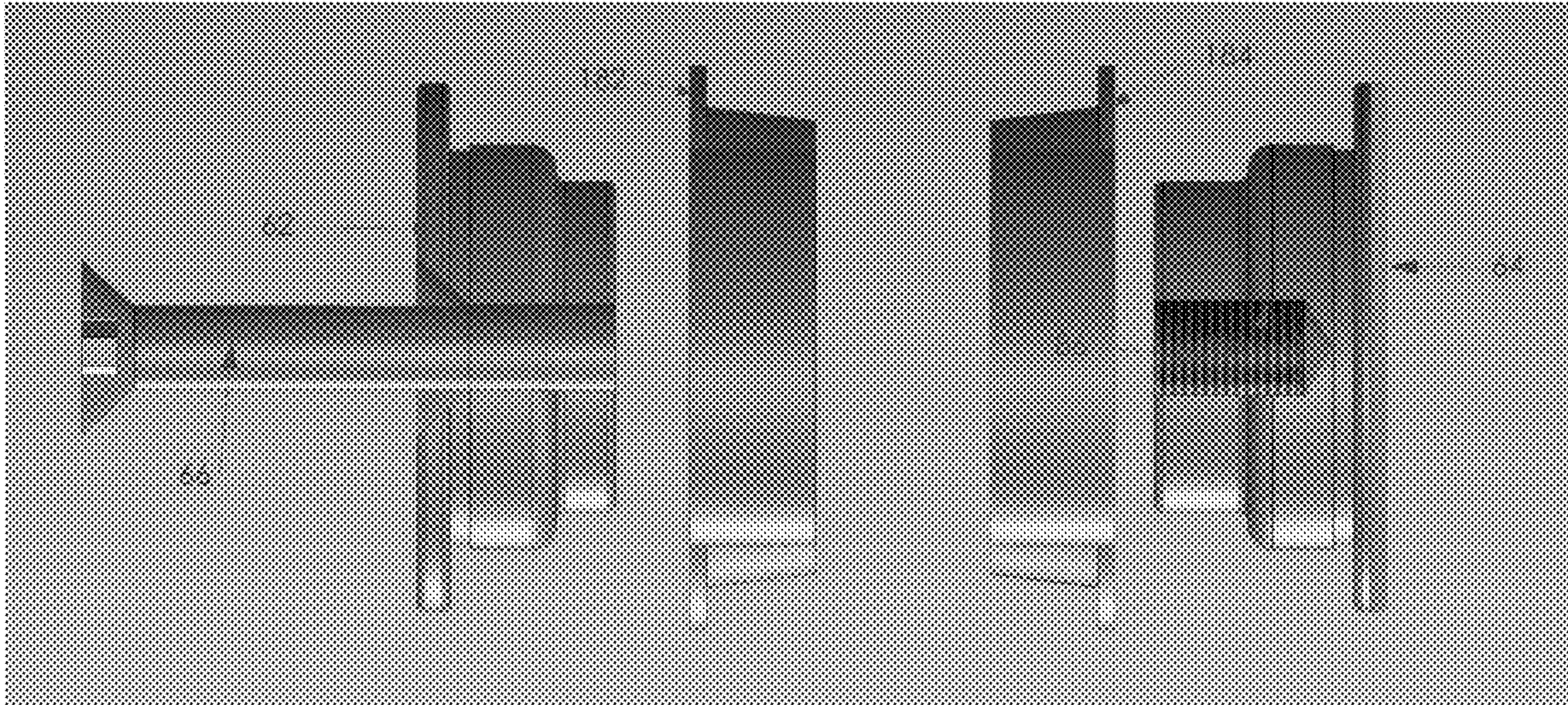


FIG. 36

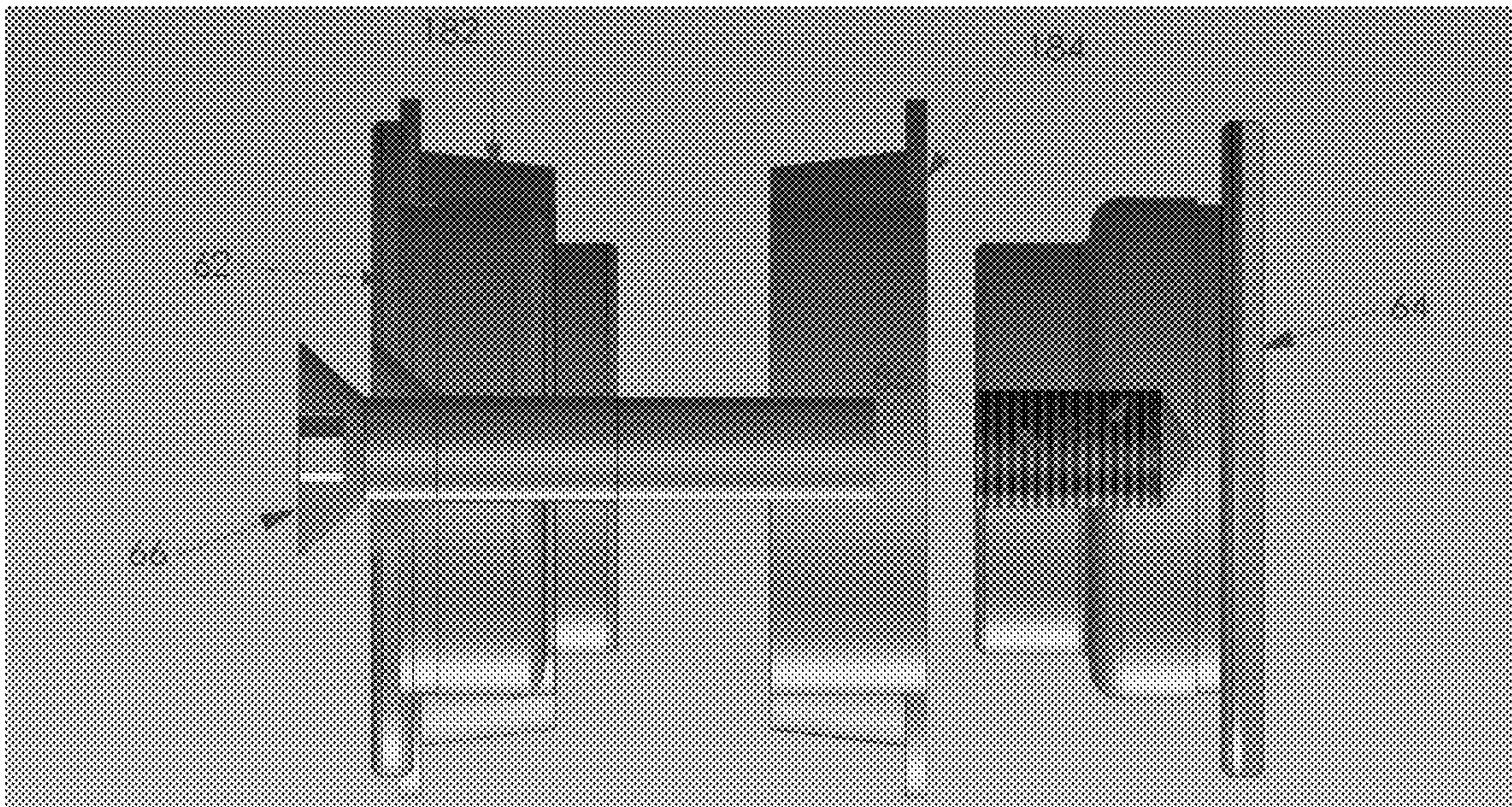


FIG. 37

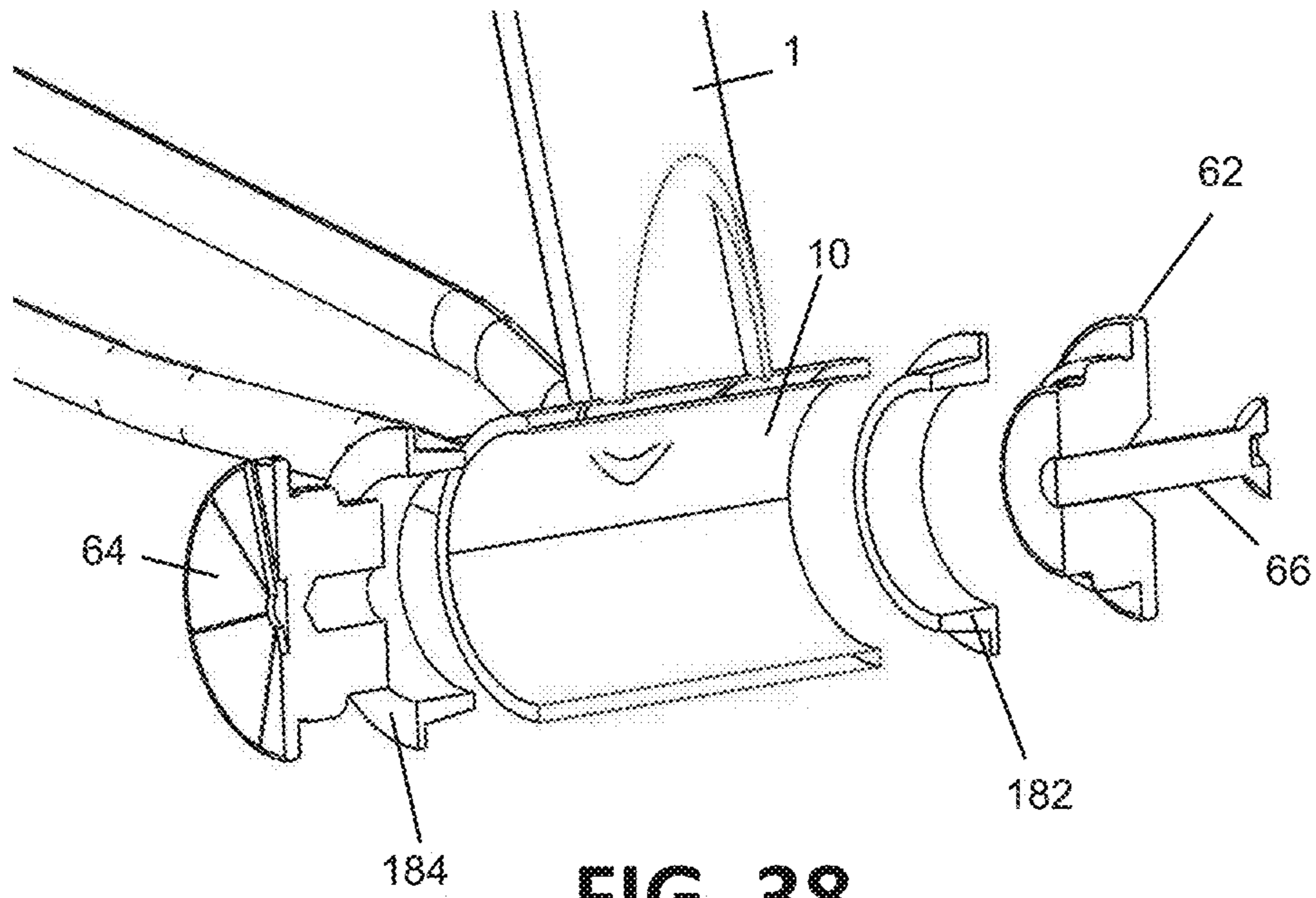


FIG. 38

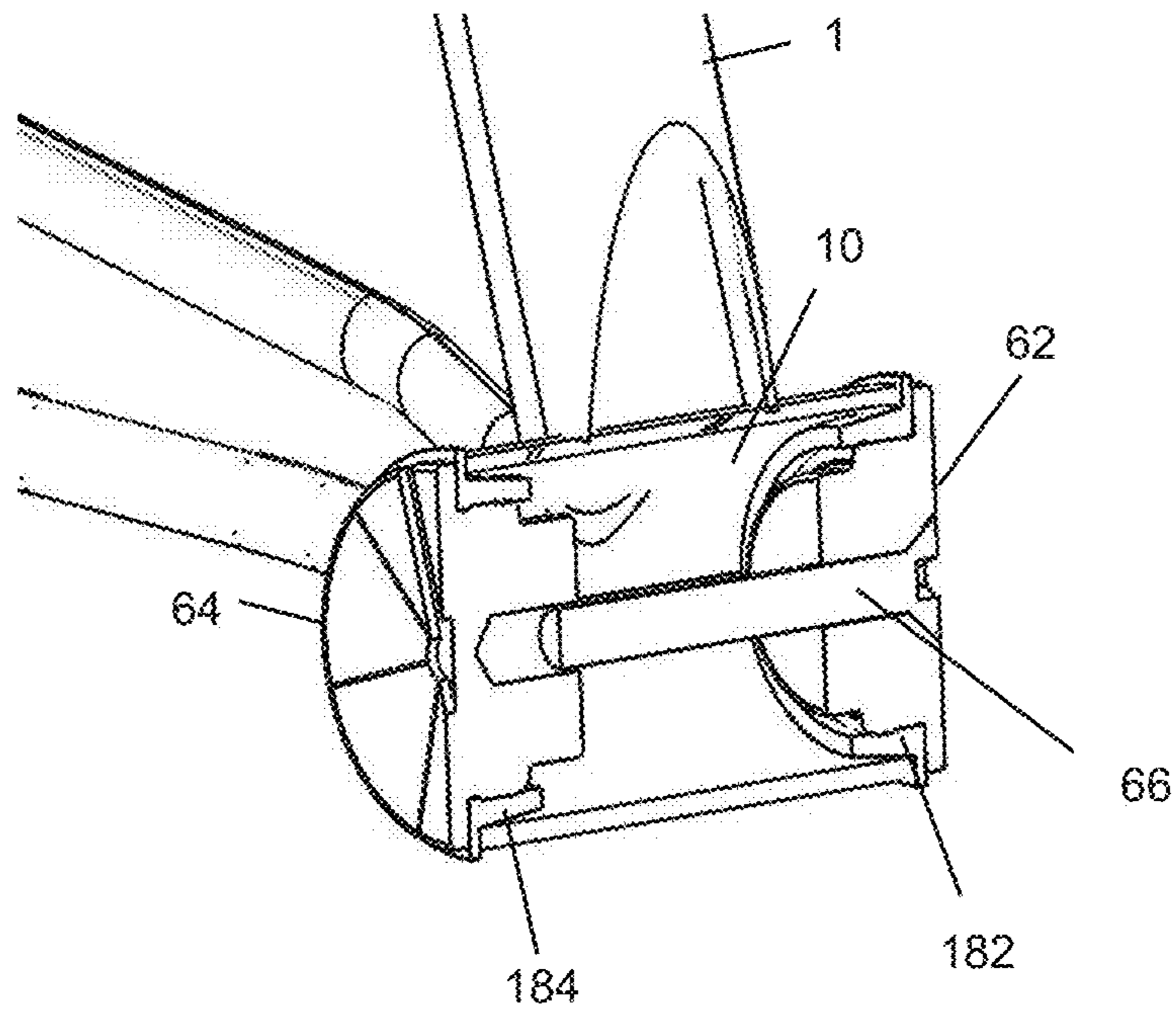


FIG. 39

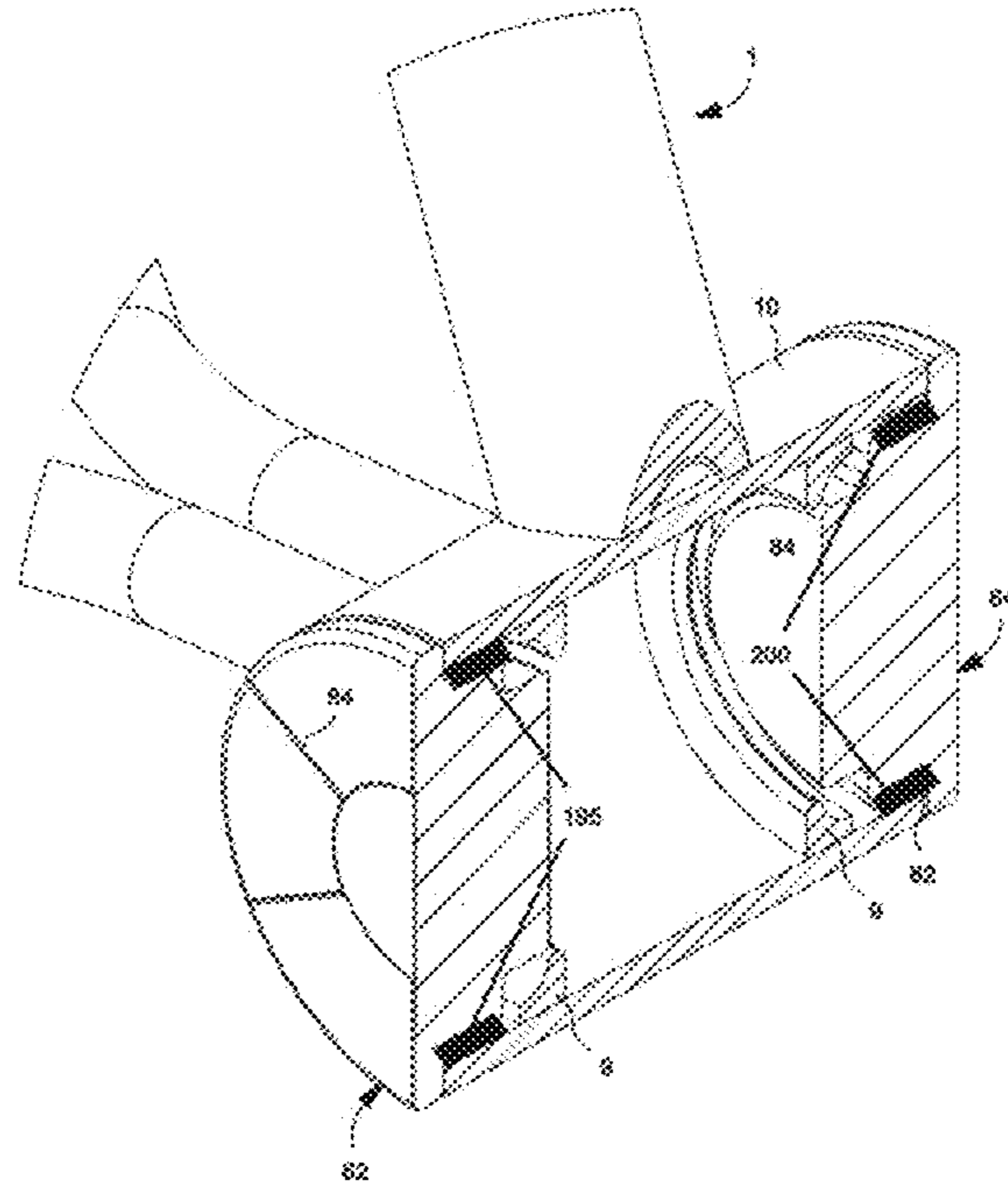


FIG. 40

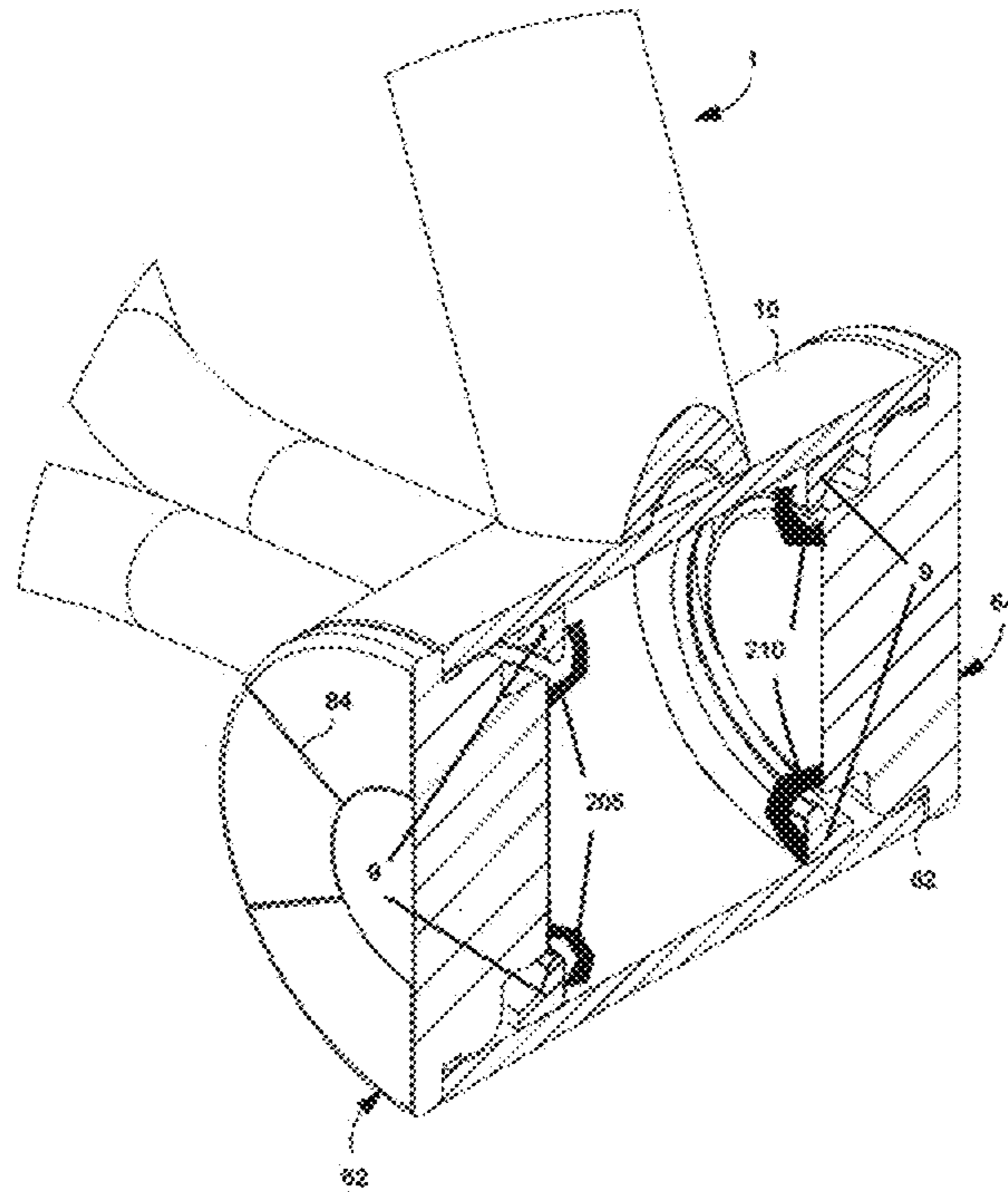


FIG. 41

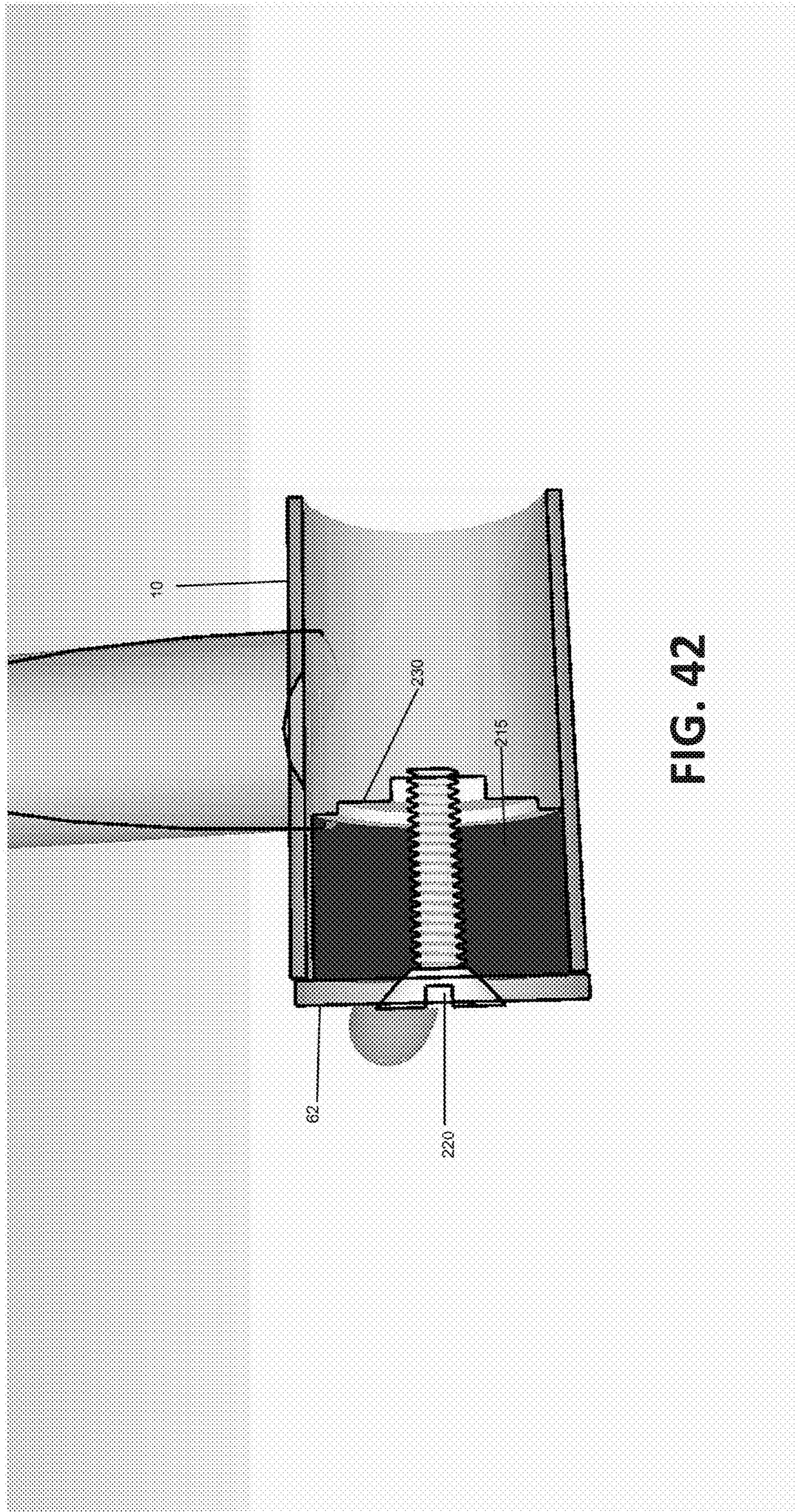


FIG. 42

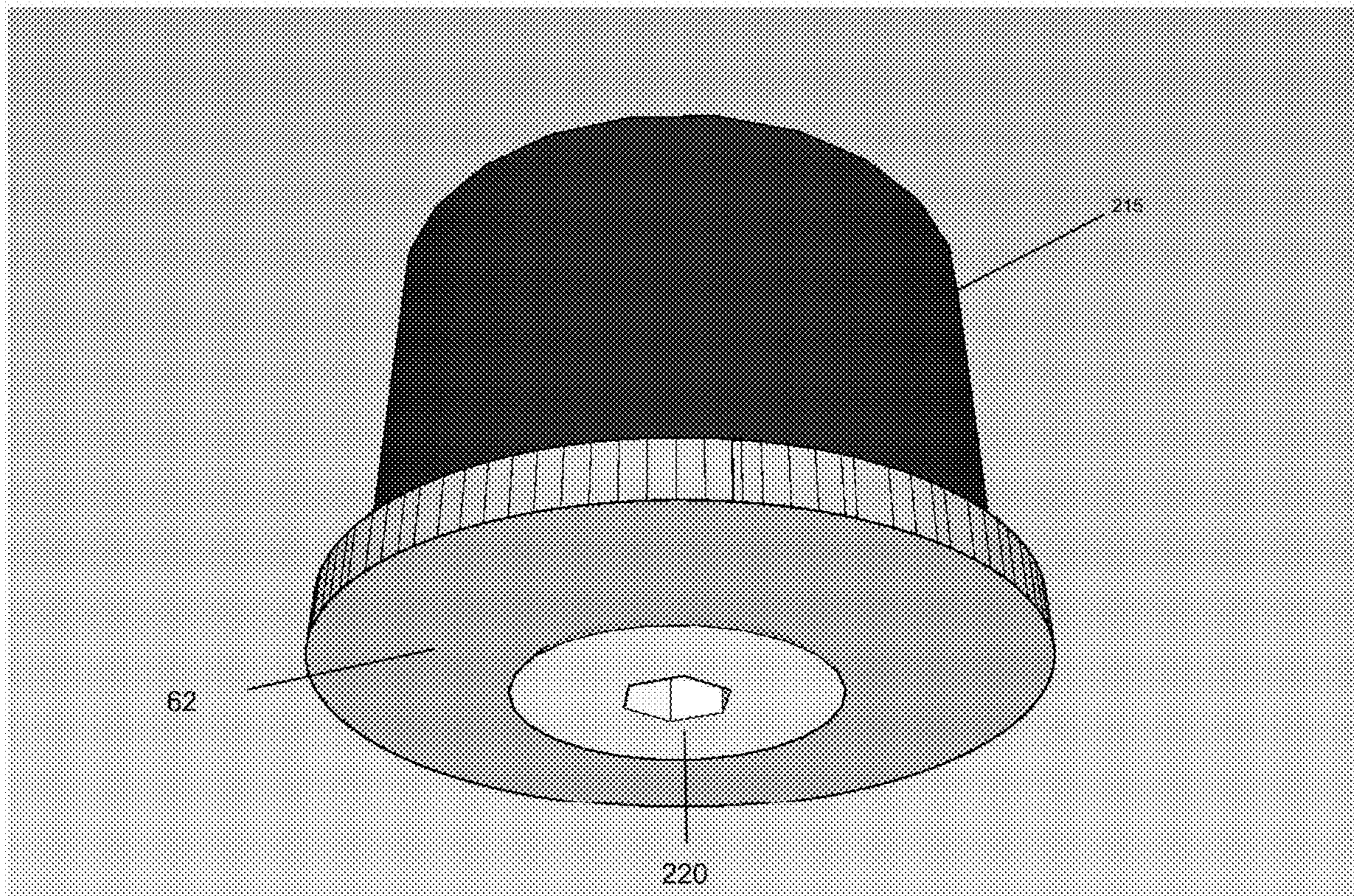


FIG. 43

BALANCE BIKE CONVERSION SYSTEMSCROSS-REFERENCE TO RELATED
APPLICATIONS

This application claims priority to and is a continuation-in-part of U.S. patent application Ser. No. 15/590,793 filed May 9, 2017 titled Balance Bike Conversion Systems which is incorporated by reference, which claims priority from U.S. Provisional Patent Application No. 62/454,342 filed Feb. 3, 2017 titled Balance Bike Adapter which is incorporated by reference.

BACKGROUND

Learning to ride a bicycle can be challenging because it requires the simultaneous exercise of multiple skills such as balancing and pedaling which is especially difficult for people with limited coordination. Many people find the learning processes to be easier when it is broken down into individual skills. This can be accomplished through the use of a balance bike which is essentially a bicycle with no pedaling mechanism. The rider propels a balance bike by coasting downhill or pushing off the ground with their feet. This isolates the steering and balancing skills from the pedaling skills and eliminates the fear of scraping ankles on pedals. Once the ability to balance and steer a balance bike has become second nature without the distraction of pedals, the rider can switch to a pedal bicycle and complete the learning process.

Balance bikes are available from many sources, but it is difficult to justify purchasing a product that will only be used for a short period of time during the learning process. Some consumers have addressed this problem by obtaining a pedal bike **1** as shown in FIG. **1** and simply removing the pedals **4**, cranks **5**, spindle **6**, bearings **7** cones (or inner bearing races) **8** and/or various other drive components such as chain guards and brackets from a pedal bicycle to convert it to a homemade balance bike as shown in FIG. **2**. However, this leaves unprotected openings in the bicycle frame which allows dirt, water and other contaminants to enter the frame and compromise the interior of the bottom bracket, the bearings, the bearing races, and other drive components when the balance bike is converted back to a pedal bike.

The unprotected frame openings are also unsightly and project an unfinished appearance which can be disconcerting to consumers who appreciate well-crafted products.

An additional problem with the unprotected openings of a homemade balance bike is that it leaves the bottom bracket vulnerable to being damaged in the event of an impact with another object. Bicycle frames (including bottom brackets) are typically made from thin metal tubes which form a strong, rigid and lightweight frame. In the unassembled state, the individual tubes are relatively weak, especially at the exposed ends. But when the ends of the tubes are welded together or finished with adequate hardware, they are much stronger and protected from impact.

When a pedal bike is converted to a home made balance bike, most or all of the hardware is removed from the bottom bracket tube, thereby leaving it exposed and more vulnerable to damage.

Moreover, the bottom bracket is located on a part of the frame that is especially vulnerable to impact. This may be understood with reference to the homemade balance bike of FIG. **2** in a situation where a new rider is learning to ride on a sidewalk along a curb-lined street. If the rider accidentally steers off the sidewalk, over the curb, and onto the street, the

bottom bracket **10** is likely to impact the curb and be damaged as the front tire drops down onto the street.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a prior art pedal bicycle.

FIG. **2** illustrates a prior art pedal bicycle that has been converted to a homemade balance bike.

FIG. **3** illustrates an embodiment of a system for converting a pedal bike to a balance bike according to the inventive principles of this patent disclosure.

FIG. **4** illustrates another embodiment of a system for converting a pedal bike to a balance bike according to the inventive principles of this patent disclosure.

FIGS. **5** and **6** illustrate a first detailed embodiment of a system for converting a pedal bike to a balance bike according to the inventive principles of this patent disclosure.

FIG. **7** is a cut-away perspective view of the fully installed components shown in FIG. **6**.

FIGS. **8** and **9** are cross-sectional views of a protective insert according to the inventive principles of this patent disclosure.

FIGS. **10**, **11** and **12** are a perspective view, an outside elevation view, and an inside elevation view, respectively of a protective insert according to the inventive principles of this patent disclosure.

FIG. **13** is a cross-sectional view of a protective insert according to the inventive principles of this patent disclosure.

FIGS. **14**, **15** and **16** are a perspective view, an outside elevation view, and an inside elevation view, respectively of a protective insert according to the inventive principles of this patent disclosure.

FIG. **17** is a cross-sectional view of a protective insert according to the inventive principles of this patent disclosure.

FIG. **18** is an exploded perspective view of a balance bike conversion kit according to the inventive principles of this patent disclosure.

FIG. **19** is a perspective view of a conversion kit shown fully assembled according to the inventive principles of this patent disclosure.

FIG. **20** illustrates a second detailed embodiment of a system for converting a pedal bike to a balance bike according to the inventive principles of this patent disclosure.

FIGS. **21** and **22** are an exploded view and an assembled view, respectively, of the system of FIG. **20** configured for use on a bike with a relatively small bottom bracket.

FIGS. **23** and **24** are an exploded view and an assembled view, respectively, of the system of FIG. **20** configured for use on a bike with a relatively large bottom bracket.

FIG. **25** is a cut-away perspective view of the fully installed components shown in FIG. **22**.

FIGS. **26** and **27** are cross-sectional views of the inserts shown in FIG. **20**.

FIG. **28** is a cut-away perspective view of the fully installed components shown in FIG. **24**.

FIG. **29** is a cross-sectional view of the adapter rings shown in FIG. **20**.

FIG. **30** show the optional pedal foot rest embodiment.

FIG. **31** shows another shape of the optional foot rest embodiment.

FIG. **32** shows a front view of the elastomeric gasket.

FIG. **33** shows a back view of the elastomeric gasket.

FIG. **34** shows a side view of the elastomeric gasket.

FIG. **35** shows a diagonal view of the elastomeric gasket.

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FIG. 36 shows an exploded view of the elastomeric gasket in conjunction with the other parts of the adapter assembly.

FIG. 37 shows a collapsed view of the elastomeric gasket in conjunction with the other parts of the adapter assembly.

FIG. 38 shows an exploded view of the elastomeric gasket in conjunction with the other parts of the adapter assembly and the bottom bracket.

FIG. 39 shows a collapsed view of the elastomeric gasket in conjunction with the other parts of the adapter assembly as they assemble in the bottom bracket.

FIG. 40 shows the magnetically secured embodiment of the adapter assembly.

FIG. 41 shows the embodiment of the adapter assembly secured by deformable clips.

FIG. 42 shows the embodiment of the adapter assembly secured by a compressive mechanism.

FIG. 43 shows an additional view of the compressive mechanism.

DETAILED DESCRIPTION

FIG. 3 is an exploded schematic view of a system for converting a pedal bike to a balance bike according to some inventive principles of this patent disclosure. The system of FIG. 3 includes a first protective insert 20 having an interface 24 that is adapted to engage one end 28 of the bottom bracket 10 of a pedal bicycle. A second protective insert 22 has an interface 26 which is adapted to engage the other end 30 of the bottom bracket 10.

A connector 32 is adapted to connect the first protective insert 20 to the second protective insert 22, thereby securing the first and second protective inserts to the bottom bracket 10. The connector 32 is adapted to adjust the distance between the first and second protective inserts, thereby accommodating variability in the width of the bottom bracket as illustrated by arrow 34. This enables the conversion system to be used with different models of pedal bikes from different manufacturers, all of which may have bottom brackets with different widths.

FIG. 4 is an exploded schematic view of another system for converting a pedal bike to a balance bike according to some inventive principles of this patent disclosure. The system of FIG. 4 includes all of the components of the system of FIG. 3, and further includes adapters 36 and 38 which enable the system to be used with a second bicycle that has a bottom bracket with openings having a different diameter (shown by arrow 40) than the first bike.

The first adapter 36 has a first interface 42 adapted to engage the interface 24 of the first protective insert 20, and a second interface 46 adapted to engage a first end 52 of the bottom bracket 50 on a second bicycle which is larger than the bottom bracket 10 of the first bicycle of FIG. 3.

The second adapter 38 has a first interface 44 adapted to engage the interface 26 of the second protective insert 22, and a second interface 48 adapted to engage the bottom bracket 50 at a second end 54 opposite the first end 52.

Depending on the implementation details, many of which are discussed in the context of the additional embodiments described below, the embodiments of FIGS. 3 and 4 may address some or all of the problems with homemade balance bikes discussed above. For example, some implementations may protect the bottom bracket from contamination, provide structural reinforcement to resist distortion from impact, and at the same time provide an attractive finished appearance. Some implementations may concentrate primarily on structural reinforcement, while others may primarily address issues relating to contamination. Yet other implementations

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may only address the aesthetics of covering the openings at the ends of a bottom bracket.

The protective inserts 20 and 22 may engage the bracket directly or through various other components that are part of the conversion system (e.g., gaskets, other adapters, etc.), or through other components that were originally part of the pedal bike (e.g., bearings, races, etc.). The inserts 20 and 22 may be positioned completely inside the end of bracket, partially inside and partially outside the bracket, or may only engage the outer face of the bracket end.

The system of FIGS. 3 and 4 may include additional components, and some components such as the connector may be omitted in some embodiments. The conversion system may be distributed as a kit which may include multiple adapters for different sizes and styles of bottom brackets, as well as components such as tools or disassembly or installation aids that do not remain on the bike after conversion, or components that may be used for converting the balance bike back to a pedal bike.

FIGS. 5 and 6 illustrate a first detailed embodiment of a system for converting a pedal bike to a balance bike according to the inventive principles of this patent disclosure. In this example, the pedal bike is a 12-inch children's bicycle which typically has a relatively small bottom bracket with correspondingly small end openings, but the inventive principles are not limited to these details. The system of FIGS. 5 and 6 may accommodate variability in the width of the bottom bracket 10 as in the embodiment of FIG. 3.

Referring to FIG. 5, the bike 1 has had all of the drive components removed from the bottom bracket 10 except for bearing races 9 as described above with reference to FIG. 2. It is common to leave the outer bearing races (or cups) 9 in the bottom bracket 10 because they may be difficult to remove or even permanently attached or formed integral with the bracket. The removed drive components are replaced with first and second protective inserts 62 and 64, respectively, and secured to the bottom bracket with a connector 66. In this embodiment, the connector 66 is implemented with a flat head screw that passes through a countersunk through-hole in the first protective insert 62 and threads into a blind threaded hole in the second protective insert 64.

FIG. 6 shows the protective inserts 62 and 64 fully installed on the bottom bracket with screw 66 tightened to hold the inserts securely in place. This embodiment may protect the bottom bracket from both contamination and structural damage while still providing a finished appearance as described in more detail below.

The first and second protective inserts 62 and 64 will now be described in more detail with reference FIGS. 7-9. Additional views are provided in FIGS. 10-19 and which are discussed further below. FIG. 7 is a cut-away perspective view of the fully installed components shown in FIG. 6. FIG. 8 is a cross-sectional view of insert 62 taken along line A-A in FIG. 16, and FIG. 9 is a cross-sectional view of insert 64 taken along line A-A in FIG. 12.

Referring to FIGS. 7 and 8, insert 62 has a profile that forms an interface that engages directly with the bottom bracket 10. The insert 62 is machined from a solid rod of aluminum alloy into a series of three cylinders of cascading size. The first cylinder 65 is essentially a disk having a relatively short length L1 and a diameter d1 that approximates the outer diameter of the bottom bracket 10. The inside surface of the disk forms a shoulder 67 that acts as a stop when the protective insert 62 is fully engaged with the bottom bracket 10.

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The second cylinder **68** has a length **L2** and a diameter **d2** that creates a close fit between the second cylinder **68** and the inside of the bottom bracket **10** as indicated by arrow **70** in FIG. 7. The fit is preferably loose enough that the insert **62** does not become wedged inside the bottom bracket **10** and become difficult to remove, but tight enough so that, in the event of an impact, the bottom bracket **10**, undergoes little or no deformation before it receives radial support from the second cylinder **68** to prevent or minimize further deformation.

The second cylinder **68** has a rounded shoulder **72** that helps center the protective insert **62** as it is being inserted into the bottom bracket **10**. The rounded shape of shoulder **72** may also accommodate the convex shape of the bearing race **9** in bikes where the positioning of the insert **62** causes the shoulder of second cylinder **68** to end up close to or up against the bearing race **9**.

The third cylinder **74** has a length **L3** and a diameter **d3** that provides clearance between the third cylinder **74** and the inside diameter of the bearing race **9** on bikes in which the bearing races **9** are positioned relatively close to the opening of the bottom bracket **10**. The stepped profile of the second and third cylinders **68** and **74** along with the rounded shoulder **72** create a profile that may cause the protective insert **62** to be self-centering and provide a fit that both protects the bearing races **9** from damage and keeps the insert **62** from vibrating in the bottom bracket **10**.

A through hole **76** and countersink **78** are sized to accept a socket flat head cap screw **66** as shown in FIG. 7. The screw **66** has a hex recess **79** to accept a hex key for tightening while still providing a safe, smooth, clean, finished appearance free of sharp edges and protrusions.

A groove **80** is formed in the second cylinder **68** where it meets the first cylinder **65**. The groove **80** accommodates an O-ring **82** which provides an enhanced seal between the protective insert **62** and the bottom bracket **10** as shown in FIG. 7.

A series of grooves **84** are formed in the outside face of the protective insert **62** giving the appearance of spokes radiating from the center. These grooves **84** have a v-shaped profile and serve a decorative function, but they may also serve a gripping function during installation and removal by serving as connection points for a spanner wrench. Other edges not specifically discussed may be rounded, chamfered, or otherwise eased for safety, ease of installation, aesthetics, etc.

Referring to FIGS. 7 and 9, the second protective insert **64** has the same general profile and dimensions as the first protective insert **62**, and features that are common to both inserts are indicated with the same reference numbers which may be omitted from FIG. 9 for simplicity. However, rather than having a through hole, the second protective insert **64** has a blind hole **86** with female threads **88** to engage the male threads on the flat head cap screw **66** as shown by arrow **89** in FIG. 7.

The third cylinder **90** of the second protective insert **64** has a length **L4** that is longer than the length **L3** of the third cylinder **74** of first protective insert **62**. This enables the screw **66** to engage the threads on the second protective insert **64** over a longer distance, thereby providing a greater range of adjustability to accommodate variances in the width of bottom brackets on different makes and models of pedal bicycles.

Also visible in FIG. 9 is a slot **92** which can be seen in more detail in FIG. 10. This slot has a rectangular cross-section which provides better gripping for a spanner wrench or other tool during installation and removal.

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FIGS. 10-19 provide some additional views and details of the embodiment of FIGS. 5-9. FIGS. 10, 11 and 12 are a perspective view, an outside elevation view, and an inside elevation view, respectively of the second protective insert **64**. FIG. 13 is a cross-sectional view taken along line A-A in FIG. 12 and provides some example dimensions that have been found to provide good engagement between the insert **64** and bottom bracket **10** on a wide range of children's bicycles (especially 12-inch bikes) available in the U.S.

FIGS. 14, 15 and 16 are a perspective view, an outside elevation view, and an inside elevation view, respectively of the first protective insert **62**. FIG. 17 is a cross-sectional view taken along line A-A in FIG. 16 and again provides some example dimensions. The shapes and dimensions shown in FIGS. 13 and 17 are intended to accommodate a 5/16-18 by 1 3/4 flat socket cap screw **66**.

FIG. 18 is an exploded perspective view of the first and second protective inserts **62** and **64**, O-rings **82** and cap screw **66**, which collectively may be referred to as a conversion kit. FIG. 19 is a perspective view of the conversion kit shown fully assembled.

The details described above are by way of example only, and may be changed in myriad ways without departing from the inventive principles. For example, the groove **80** and O-ring **82** may be omitted from each insert and replaced by a flat washer made of rubber, paper, etc., positioned between the shoulder **67** and the outer edge **94** of the bottom bracket. Alternatively, no separate sealing component may be included, and the surface-to-surface interface between the shoulder **67** and the outer edge **94** of the bottom bracket **10** may provide adequate sealing in some applications.

In other implementations, the first cylinder **65**, along with its corresponding shoulder **67** may be omitted entirely, in which case the shoulder **72** of the second cylinder **68** insert may stop against the bearing race **9** when the assembly is tightened down with screw **66**. In this configuration, the close fit between the second cylinder **68** and the inside surface of the bottom bracket **10** may provide adequate sealing against contamination. As another variation, the diameter of the first cylinder **65** may be reduced so it is the same diameter as, or slightly larger than, the second cylinder **68** with the groove **80** and O-ring **82** retained so the O-ring is drawn further into the bottom bracket and provides additional sealing as the inserts are drawn against the bearing races during installation.

With the example bike illustrated in FIGS. 5 and 7, the bearing races **9** are shown as separate components that are located inside the bottom bracket **10** a certain distance back from outer edge **94** of the bottom bracket. With other bikes, however, the bearing races may be fabricated as part of components known as cups that are pressed into the ends of the bottom bracket. Each cup typically has a flange that stops against the outer edge **94** of the bottom bracket to position the cup in the bracket. With such a bike, the cups are typically difficult to remove and may be left in place and considered part of the bottom bracket. Alternatively, the cups may be removed. Depending on the specific bike manufacturers and models, the size and shape of the interface of a single protective insert design may adequately engage bikes both with and without cups. With other bike manufacturers and models, however, it may be preferable to provide protective inserts with different interfaces.

As further examples of possible variations to the embodiment described above with respect to FIGS. 5-19, the rounded shoulders **72** may be eliminated or chamfered, the third cylinder **74** may be omitted, the blind hole **86** may be a through-hole, a socket head cap screw or hex head cap

screw may be used, in which case a counterbore may be substituted for the countersink 78, or a completely different types of screw or connector may be used, etc.

Aluminum alloy may be a good choice of material because it is lightweight, easy to machine, rigid and sturdy which helps prevent distortion of the bottom bracket and bearing races in the event of an impact with another object (from riding, or dropping, etc.). However, other rigid materials, such as steel, hard plastic, composite materials, etc., may be utilized. In embodiments where structural support for the bottom bracket is not a concern, flexible materials such as rubber or soft plastics may be used in which case the O-ring may be omitted because the entire insert may provide a sealing effect.

FIG. 20 illustrates a second detailed embodiment of a system for converting a pedal bike to a balance bike according to the inventive principles of this patent disclosure. The system of FIG. 20, which may be referred to as a multi-fit system, may accommodate variability in both the width and the diameter of the bottom bracket of a pedal bike as in the embodiment of FIG. 4.

The system includes first and second protective inserts 96 and 98 and a connector 100 that is integral with the first insert 96. The first and second inserts each include an interface 110 (only visible on the second insert 98 in this view) that is adapted to engage an end of the bottom bracket.

The connector 100 includes a male threaded portion 106 that engages female threads 108 in the second insert 98 to secure the inserts to the bottom bracket of a bicycle and accommodate variability in the width of the bottom bracket.

The system also includes two ring-shaped adapters 102 and 104 that may be used to install the inserts on a bicycle with a wider diameter bottom bracket. Each of the adapter rings 102 and 104 includes a first interface 112 on its outer side (only visible on the first adapter 102 in this view) that engages the interface of the corresponding protective insert. Each of the adapter rings 102 and 104 also includes a second interface 114 on its inner side (only visible on the second adapter 104 in this view) that engages an end of a larger diameter bottom bracket. Thus, the adapter rings 102 and 104 may be omitted when the system is installed on a smaller bottom bracket, but included when it is installed on a larger bottom bracket.

Another feature of the embodiment of FIG. 20 is that it is designed to retain the bearings 7 of a pedal bike inside the bottom bracket when it is converted to a balance bike. This affords the user the option of storing and thereby protecting the bearings in the bottom bracket. This is illustrated in FIG. 21 which is an exploded view of protective inserts 96 and 98, connector 100 and bearings 7 prior to assembly on the bottom bracket 10 a smaller (e.g., 12 inch) children's bike 1. FIG. 22 shows the protective inserts 96 and 98 fully installed on the bottom bracket 10 with connector 100 tightened to hold the inserts securely in place. In this configuration, the adapter rings 102 and 104 are not needed.

FIG. 23 illustrates the use of the system of FIG. 20 on a larger (e.g., 16 inch) children's bike 13 where the first and second adapter rings 102 and 104 are positioned between the protective inserts 96 and 98 and the larger bottom bracket 50. The larger bearings 15 and bearing inner races 17 are visible in this view. FIG. 24 shows the components fully installed on the bottom bracket 50 with connector 100 tightened to hold the inserts 96 and 98 and adapter rings 102 and 104 securely in place.

The first and second protective inserts 96 and 98 will now be described in more detail with reference to FIGS. 25-27 where FIG. 25 is a cut-away perspective view of the fully

installed components shown in FIG. 24, FIG. 26 is a cross-sectional view of insert 96, and FIG. 27 is a cross-sectional view of insert 98.

The second protective insert 98 has an interface that includes a disk-shaped portion 112 with a flat inner surface 114 forming a shoulder that seats against the outer edge 94 of bottom bracket 10. The disk-shaped portion 112 has a length L1 and a diameter d1 that preferably matches the outside diameter of bottom bracket 10. The interface also includes a cylindrical portion 116 having a diameter d2 and a length L2 that extends into the end of the bottom bracket 10. A cone-shaped portion 118 of the interface has a concave race surface 120 that engages the ball bearing 7 which is restrained between the cone portion 118 and one of the bearing inner races 9.

The second protective insert 98 also include a female threaded through-hole 108, as well as radially aligned grooves 122, 124, 126 and 124 which are most visible in FIG. 25. Groove 128 has a rectangular cross-section which may be readily engaged by a spanner wrench for installation and removal, while the other grooves have a V-shaped cross-section and are intended primarily for ornamentation.

The first protective insert 96 has one end with a cross-sectional profile that is essentially the same size and shape as the profile of the second protective insert 98 and engages the other end of the bottom bracket 10. The integral connector 100 forms a shaft that extends from first protective insert 96 and terminates in a male threaded portion 106 that engages the female threaded through-hole 108 of the second protective insert 98 when the inserts are installed on the bottom bracket 10. The shaft preferably has a diameter d4 that provides a close fit with the ball bearing 7 so the shaft is self-aligning. During assembly, one of the ball bearings can be slipped over the shaft of the first protective insert 96 which is then inserted into one end of the bottom bracket 10. The other ball bearing is then slipped into the other end of the bottom bracket 10 and over the threaded portion 106 of the shaft. The second protective insert 98 is then threaded onto the threaded portion 106 of the shaft 100 and either or both of the inserts 96 and 98 are rotated until the inserts are securely seated against the end faces of the bottom bracket as shown in FIG. 25.

A benefit of the embodiment of FIG. 25 is that it may enclose the ball bearings in a clean, dry and safe environment while the bike is being used as a balance bike. The ball bearings tend to be the most fragile of the pedal bike drive components, and they are vulnerable to dirt, moisture, physical damage and misplacement when removed from the bottom bracket. The bearing retainers are typically made of a relatively soft metal that is easily bent if dropped, stepped on, or otherwise mishandled. The ball bearings are protected from these hazards, however, when enclosed inside the bottom bracket by the protective inserts.

A further benefit of the embodiment of FIG. 25 is that it may enable the ball bearings to provide physical support to the bottom bracket. If the protective inserts 96 and 98 are sized and positioned so the ball bearings 7 are held securely between the cone-shaped portions 118 and the bearing outer races 7, the ball bearings may provide radial support to the bottom bracket 10 while the bike is being used as a balance bike. Although the bearings 7 tend to be fragile in the unassembled state, when installed between race surfaces they can bear a heavy radial load which is their intended function.

The first and second adapter rings 102 and 104 will now be described in more detail with reference to FIGS. 28-29 (and FIGS. 26 and 27) where FIG. 28 is a cut-away

perspective view of the fully installed components shown in FIG. 24, and FIG. 29 is a cross-sectional view of adapter rings 102 and 104. The first and second protective inserts 96 and 98 and integral connector 100 are the same as in FIGS. 25-27.

The first and second adapter rings 102 and 104 may be manufactured as identical components. Each has an outer diameter d_5 that preferably matches the outer diameter of the bottom bracket 50. Each adapter ring includes a through-hole 130 having a diameter $d_2^{(+)}$ that is slightly larger than the diameter d_2 of the cylindrical portion 116 of the protective inserts 96 and 98. The through hole has a counter-bored portion 130 on the outer side having a depth L_1 and a diameter $d_1^{(+)}$ that is slightly larger than the diameter d_1 of the disk-shaped portion 112 of the protective inserts 96 and 98. These dimensions enable the outer face of the protective inserts 96 and 98 to sit flush with the outer faces of the adapter rings 102 and 104 when installed on the bottom bracket 50 as shown in FIGS. 28 and 24.

The counterbored portion 130 forms the first interface 112 of each adapter ring as shown in FIG. 20. The second interface 114 of each adapter ring includes a shoulder surface 142 that engages the outer edge of the bottom bracket 50 and a cone-shaped portion having a concave surface 144 that may engage the ball bearings 15.

Each adapter ring may also include radially aligned grooves 134, 136, 138 and 140 which may all have a V-shaped profile and which preferably align with the grooves 122, 124, 126 and 124 on each of the protective inserts 96 and 98.

All of the components of the system illustrated in FIGS. 20-29 may be machined from aluminum alloy. The first protective insert 96 and integral connector 100 may be machine from a single piece of metal, or the connector 100 may be formed separately and attached to the insert 96 by welding, press fitting into a hole, or any other suitable technique.

The details described above are by way of example only, and may be changed in myriad way without departing from the inventive principles. For example, the components may be fabricated from any other suitable material. The cone shaped portions may have straight rather than concave surfaces. The protective inserts and/or adapter rings may include an additional cylindrical portion that fits closely inside the bottom bracket to provide radial support to protect the bottom bracket from distortion. Washers or O-rings may be included between the inserts and/or adapter rings and bottom bracket and/or between inserts and adapter rings. The adapter rings may include an additional cylindrical portion to position the cone further into the bracket to engage the bearings.

The adapter rings have been described in the context of the multi-fit embodiment of FIGS. 20-29, but a similar arrangement may also be utilized with the first detailed embodiment of FIGS. 5-19.

Some additional inventive principles of this patent disclosure relate to the addition of foot rests to a balance bike conversion system. Removing the pedals and cranks from a pedal bike may reduce the distractions and complexity while learning to ride, but some riders may still prefer to have place to rest their feet, especially as their balance skills improve. FIG. 30 illustrates an embodiment of a system for converting a pedal bike to a balance bike having foot rests according to the inventive principles of this patent disclosure. The embodiment of FIG. 30 includes protective inserts 97 and 99 similar to inserts 96 and 98 shown in FIG. 22 but with attachment points for mounting the pedals 4 which

were removed from the pedal bike as shown in FIG. 2. For example, the insert 97 with the integral connector may be drilled and tapped at either end to accept the right and left hand threads of the pedals. An advantage of this embodiment is that it makes use of components that are already available.

FIG. 31 illustrates another embodiment of a system for a pedal bike to a balance bike having foot rests according to the inventive principles of this patent disclosure. The embodiment of FIG. 31 includes a first protective insert 146 having an integral connector 150, and a second protective insert 148 having a hole 152 adapted to receive the end of the connector 150. For example, the connector 150 and hole 152 may have matching male and female threads, respectively. The first and second inserts 146 and 148 each has a slot 154 and 156, respectively, adapted to receive a tab on a foot rest. One example foot rest 164 is formed as a semi-circular disk with a tab 160 disposed along the flat edge of the foot rest. The foot rest may be mounted to either of the protective inserts 146 and 148 by engaging the tab 160 with the slot on the foot rest. The footrest 164 includes a protrusion 174 having a hole 172 that aligns with either of the holes 166 or 168 on the first and second inserts 146 and 148 to enable the foot rest to be securely fastened to the insert with a screw or other suitable fastener.

Another example foot rest 162 is formed with more of a peg shape, in this example having a hexagonal cross-section. The foot rest 162 also includes a tab 158 and hole 170 to enable it to be fastened to the insert with a screw or other suitable fastener.

Either of the example foot rests may be fabricated from any suitable material such as hard or soft rubber, aluminum alloy, etc. An advantage of the embodiments illustrated in FIG. 31 is that the foot rests may also function as fastening aids or tools to help the installer tighten the protective inserts 146 and 148 to the bottom bracket of a pedal bike. They may, for example, aid the installer in applying torque to tighten the inserts if the connector 150 and hole 152 are fabricated with mating threads.

Since the inventive principles of this patent disclosure can be modified in arrangement and detail without departing from the inventive concepts, such changes and modifications are considered to fall within the scope of the following claims.

In some additional embodiments, elastomeric gaskets 182 are used in place of adapter rings in the multi-fit embodiments of FIGS. 20-29 where the balance bike adapter is being installed into large bottom brackets. An example elastomeric gasket is shown in FIGS. 32-39 and is shaped like a ring, with a flat circular base 180, and a conical (frustoconical) portion 185 which extends upwards from the flat circular base, to form a second flat surface 181 at the top of the conical portion of the gasket. The elastomeric gasket goes in between the protective inserts 62/64 or 96/98 and the bottom bracket 10, to take the place of the rigid multi-fit adapter which would otherwise be required to install the balance bike adapter in a large bottom bracket. The elastomeric gasket may be advantageous over the multi-fit embodiment of FIGS. 20-29 because it may be able to accommodate greater variations in bottom brackets with a single gasket. Further, it may include fewer parts, and may be easier to install relative to some other multi-fit embodiments.

The elastomeric gasket 182 may also act as a sealing member, taking the place of the O-rings 82 in the embodiments in which it is used. It acts as a sealing member by compressing into the space between the bottom bracket 10

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and the protective insert **62/64**, thereby eliminating any avenue for debris or moisture to enter into the bottom bracket **10**.

In an additional embodiment, ferromagnetic points **195/200** on the protective inserts **62/64** are used to attach the protective inserts to the bottom bracket **10**, as shown in FIG. **40**. The protective inserts are held in place by the magnetic force between the ferromagnetic points on the protective insert and the bottom bracket.

In an additional embodiment, elastically deformable clips **205/210** are used to attach the protective inserts **62/64** to the bottom bracket **10** by clipping onto an interior ridge within the bottom bracket, as shown in FIG. **41**. The interior ridges which the elastically deformable clips **205/210** attach to may be the bearing races **9**, but may also be other interior ridges inside the bottom bracket. The elastically deformable clips may be fabricated from plastic or a flexible metal such that they can be bent during insertion and removal of the protective inserts, without breaking. The elastically deformable clips are approximately the size of interior of the bottom bracket such that they snap into place when fully inserted.

In an additional embodiment, the protective inserts have a compressive mechanism and an elastically deformable material **215** which attaches the protective insert **62** to the bottom bracket **10** by applying a compressive force against the wall of the bottom bracket, as shown in FIG. **42**. The elastic material may be rubber or silicone and is pushed outward by the application of compressive force to both sides of the elastic material by the protective insert **62** and an inner plate **230**, each on one side of the elastic material, causing it to be pushed outward through the gap between the two plates. The compressive force may be applied by a screw action using a fastener **220** between the protective insert **61** and the inner plate **230**, causing the two plates to move closer together, thereby compressing the elastic material, and causing it to impart a compressive force to the interior of the bottom bracket, thereby securing the protective insert to the bottom bracket. The fastener **220** differs from the connector used in other embodiments in that it is only used by the compressive mechanism to impart a force on the walls of the bottom bracket, as opposed to secure one protective insert to the other protective insert on the opposite side of the bottom bracket.

The invention claimed is:

1. A conversion kit for converting a pedal bicycle for use as a balance bicycle by removing the pedals, cranks, and a spindle from the pedal bicycle and replacing them with components of the conversion kit, the pedal bicycle comprising a bottom bracket, the conversion kit comprising:

a first protective insert having an interface adapted to engage to a first end of the bottom bracket of the bicycle; and

a second protective insert having an interface adapted to engage to a second end of the bottom bracket, opposite the first end;

wherein the first protective insert secures itself to the bottom bracket;

wherein the second protective insert secures itself to the bottom bracket

wherein the first protective insert secures itself to the bottom bracket by attaching to an interior ridge; and wherein the interior ridge is a bearing race.

2. A conversion kit for converting a pedal bicycle for use as a balance bicycle by removing the pedals, cranks, and a spindle from the pedal bicycle and replacing them with components of the conversion kit, the pedal bicycle comprising a bottom bracket, the conversion kit comprising:

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a first protective insert having an interface adapted to engage to a first end of the bottom bracket of the bicycle; and

a second protective insert having an interface adapted to engage to a second end of the bottom bracket, opposite the first end;

wherein the first protective insert secures itself to the bottom bracket;

wherein the second protective insert secures itself to the bottom bracket

wherein the first protective insert secures itself to the bottom bracket by attaching to an interior ridge; and

wherein the protective inserts are secured to the interior ridges of the bottom bracket by flexible clips attached to the protective inserts.

3. A conversion kit for converting a pedal bicycle for use as a balance bicycle by removing the pedals, cranks, and a spindle from the pedal bicycle and replacing them with components of the conversion kit, the pedal bicycle comprising a bottom bracket, the conversion kit comprising:

a first protective insert having an interface adapted to engage to a first end of the bottom bracket of the bicycle; and

a second protective insert having an interface adapted to engage to a second end of the bottom bracket, opposite the first end;

wherein the protective inserts secures themselves to the bottom bracket magnetically.

4. A conversion kit for converting a pedal bicycle for use as a balance bicycle by removing the pedals, cranks, and a spindle from the pedal bicycle and replacing them with components of the conversion kit, the pedal bicycle comprising a bottom bracket, the conversion kit comprising:

a first protective insert having an interface adapted to engage to a first end of the bottom bracket of the bicycle; and

a second protective insert having an interface adapted to engage to a second end of the bottom bracket, opposite the first end;

wherein the protective inserts secure themselves to the bottom bracket by applying a compressive force to the walls of the bottom bracket.

5. A conversion kit for converting a pedal bicycle for use as a balance bicycle by removing the pedals, cranks, and a spindle from the pedal bicycle and replacing them with components of the conversion kit, the pedal bicycle comprising a bottom bracket, the conversion kit comprising:

a first protective insert having an interface adapted to engage to a first end of the bottom bracket of the bicycle;

a second protective insert having an interface adapted to engage to a second end of the bottom bracket, opposite the first end;

a first adapter having: a first interface adapted to engage the interface of the first protective insert, and a second interface adapted to engage the first end of the bottom bracket; and

a second adapter having: a first interface adapted to engage the interface of the second protective insert, and a second interface adapted to engage the second end of the bottom bracket, opposite the first end;

wherein the first and second adapters are elastomeric gaskets adapted to fit between the first and second protective inserts and the bottom bracket, thereby allowing the protective inserts to fit into a larger sized bottom bracket.

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6. The kit of claim 5 wherein the first and second elastomeric gaskets have a circular base and a conical body extending upward from the circular base.

7. The kit of claim 6 in which the elastomeric gasket includes silicone.

8. A conversion kit for converting a pedal bicycle for use as a balance bicycle by removing the pedals, cranks, and a spindle from the pedal bicycle and replacing them with components of the conversion kit, the pedal bicycle comprising a bottom bracket, the conversion kit comprising:

a first protective insert having an interface adapted to engage to a first end of the bottom bracket of the bicycle;

a second protective insert having an interface adapted to engage to a second end of the bottom bracket, opposite the first end;

a first sealing member arranged to provide a seal between the first protective insert and the first end of the bottom bracket; and

a second sealing member arranged to provide a seal between the second protective insert and the second end of the bottom bracket.

9. The kit of claim 8 wherein:

the interface of the first protective insert includes a groove to receive the first sealing member; and

the interface of the second protective insert includes a groove to receive the second sealing member.

10. The system kit of claim 8 wherein the first and second sealing members comprise O-rings.

11. The kit of claim 8 wherein:

a first elastomeric gasket acts as the sealing member between the first protective insert and the first end of the bottom bracket; and

wherein a second elastomeric gasket acts as the sealing member between the second protective insert and the second end of the bottom bracket.

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12. The system kit of claim 8 wherein:

the sealing member between the first protective insert and the first end of the bottom bracket comprises a first elastomeric gasket; and

wherein the sealing member between the second protective insert and the second end of the bottom bracket comprises a second elastomeric gasket.

13. A conversion kit for converting a pedal bike for use as a balance bike by removing the pedals, cranks and a spindle from the pedal bike and replacing them with components of the conversion kit, the pedal bike comprising a first bottom bracket, the conversion kit comprising:

a first protective insert having means for engaging a first end of the first bottom bracket;

a second protective insert having means for engaging a second end of the first bottom bracket opposite the first end;

a means for securing the first and second protective inserts to the first bottom bracket and accommodating variability in a width of the first bottom bracket;

a first inner plate;

a second inner plate;

a first elastic material positioned between the first protective insert and the first inner plate;

a second elastic material positioned between the second protective insert and the second inner plate;

a first fastener connecting the first protective insert and the first inner plate which moves the first protective insert and the first inner plate closer together when engaged; and

a second fastener connecting the second protective insert and the second inner plate which moves the second protective insert and the second inner plate closer together when engaged.

14. The kit of claim 13 wherein the fasteners connecting the protective inserts and the inner plates are drawbolts, which moves the protective inserts and inner plates closer together by screw action.

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